

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard	1	2	3	4
A01 = Structure of microcard			SIS	
B01 = Trouble-shooting chart	A-***X*	X*XXX	XXXXX	XXXXX *XXXX X
	B-XXXX	XXXXX	XXXXX	XXXXX XXX
	C-XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-XXXXX	XXXXX	XXXXX	XXXXX XX
	F-XXXXX	XXXXX	XXXXX	XXX
	G-XXXXX	XXXXX	XXXX	
	H-			
	J-			
	K-			
	L-			
	M-			
N01 = Service information	N-XXXX	XXXXX	XXXXX	XXX *X XX*
	12345	67890	12345	67890 12345 678
		1	2	
				Index

N28 = Table of contents and publication information

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Testers and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

Beginning	Mid-section	End	One-page section
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A01		=> <=
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This microcard contains the following vehicle models with LE 1-Jetronic:

- * BMW 320i from 11.1982 to 08.1984 with control unit no. 0 280 001 301
- * BMW 323i from 11.1982 to 08.1984 with control unit no. 0 280 001 301
- * BMW 520i from 9.1982 to 08.1984 with control unit no. 0 280 001 301
- * As of 09.84, all models have been converted to LE 2-Jetronic (work in).
- * BMW 320i/520i as of 09.1984 with control unit no. 0 280 001 309
- * BMW 323i as of 09.1984 with control unit no. 0 280 001 308

SPECIAL FEATURES:

- * Partly with in-tank pre-supply pump
- * O-Ring connection of solenoid-operated injection valves and pressure regulator.
- * In the 3 series, the fuel filter is located in the engine compartment.
- * Throttle-valve positioner
- * Until 08.84, pressure switch for part-load enrichment
- * Until 08.84, diaphragm dampers in fuel supply and return lines.

As of 09.84 (introduction of LE 2-Jetronic)

- * Start control (solenoid-operated start valve and thermo-time switch discontinued)
- * t p actuation
- * Engine-speed limiting; this function therefore no longer carried out in ignition distributor.
- * Load-dependent enrichment, hence pressure switch eliminated.
- * Adaptive overrun cut-off.
- * Diaphragm dampers in fuel supply and return lines eliminated.
- * Plug connectors include unlatching clip for better pulling.

A02		=>
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Sweden/Switzerland/Australia version:

- * Secondary-air induction
- * Ignition change-over relay
- * Vacuum advance
- * Solenoid-operated change-over valve

Austria version:

- * On the 520 i the power has been reduced to 88 kW (120 bhp) by alteration of the valve timing (yellow marking on camshaft timing gear advanced 3°).

Difficulties in setting the CO concentration

In these vehicles, the CO content must be measured at the exhaust manifold. The difference between the two cylinder groups must not exceed 0.5 vol. %. Should the difference be larger, interchange one or two solenoid-operated injection valves of the cylinder groups. Then adjust the CO content of the "lean" cylinder group to 1 vol. %.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

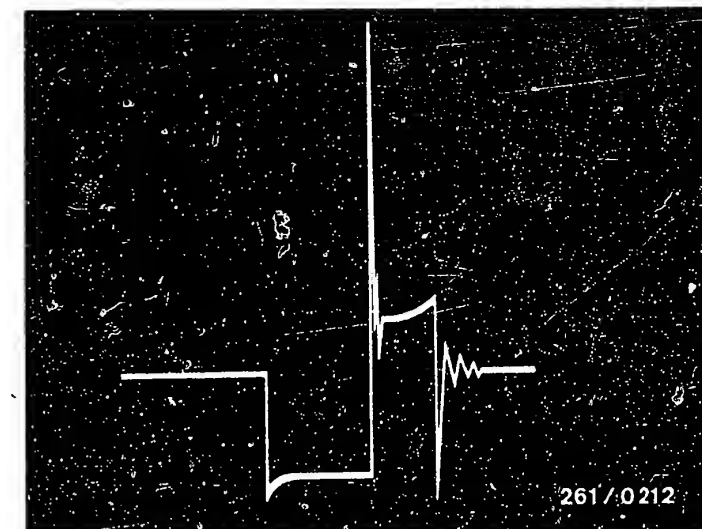
The following rapid diagnosis chart makes it possible for the experienced L-Jetronic expert to quickly check the electrical part of the system with the universal test adapter. The rapid diagnosis chart contains the following information:

- * Sequence of test steps.
- * Settings of V and Ω program switches.
- * Notes on how to operate the universal test adapter or other components.
- * Test specifications for motortester and multimeter.
- * Reference to Coordinates of the relevant detailed testing and trouble-shooting program.

If detailed instructions and information are required, always proceed according to the trouble-shooting charts starting on Coordinates C01.

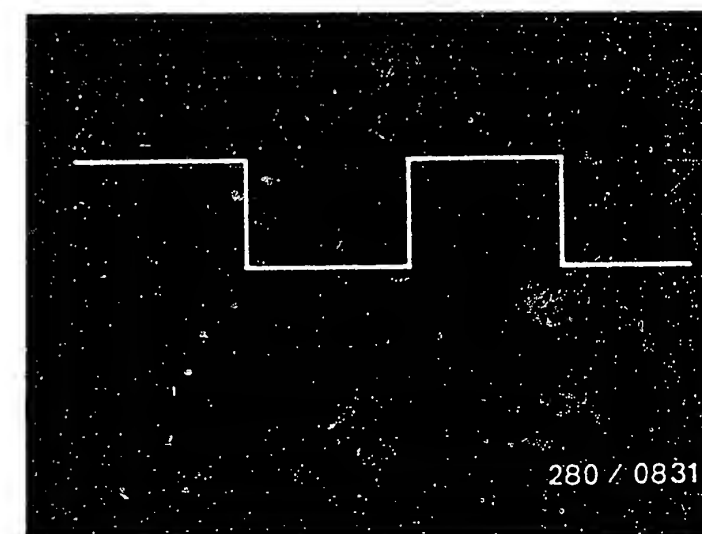
Rapid diagnosis chart for universal test adapter

Test step	Switch position V Ω	Remarks	Control-unit plug between terms.	Test specifications (reading)	Trouble-shooting see coordinates
1	5 -	Disengage gear and start. <u>until 10.84</u> Term. 1, term. 16 at ignition trigger box. <u>as of 11.84</u> t _D signal.	1 <==> 5 1 <==> 5	See upper illustration See lower illustration	C11
2	6 -	Disengage gear and start. Voltage at control relay term. 87	9 <==> 5	<u>8...15 V</u>	C15
3	7 -	Disengage gear and start. Voltage at starting motor term. 50	4 <==> 5	<u>8...15 V</u>	C17
4	 V 11	Resistance of temperature sensor NTC I.	8 <==> 5	<u>100...200</u> Ω	C19
5	 V 12	Deflect sensor plate to stop. Resistance of air-flow sensor potentiometer.	7 <==> 5	<u>60...1000</u> Ω	C21



Until 09.84:
Primary signal

As of 09.84:
t_D signal



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

Test step	Switch position V Ω	Measurement	Control-unit between terms.	Remarks	Test specifications (reading)	Trouble-shooting see coordinates
6	 V	13 Resistance of temperature sensor NTC II (engine temperature)	10 <==> 5	until 10.84: (15°C...+30°C) (+80°C) as of 11.84: (+15°C...+30°C) (+80°C)	1,3...3,6 k Ω 250...390 Ω 1,45...3,3 k Ω 280...360 Ω	C23
7	 V	14 Resistance, ground output stage	13 <==> 5	—	0...10 Ω	C25
8	 V	15 Resistance, ground output stage	25 <==> 5	—	0...10 Ω	C27
9	 V	16 Resistance of idle contact in throttle-valve switch	2 <==> 9	Accelerator pedal at rest	0...10 Ω	D01
10	 V	17 Resistance of full-load contact in throttle-valve switch	3 <==> 9	Fully depress accelerator pedal (full-load position)	0...10 Ω	D05
11	 V	17 Pressure switch (where present)	3 <==> 9	Operate Mityvac pump from 0 to 260 mbar	28...32 k Ω	D07
12	 V	18 Resistance of all 3 parallel-connected solenoid-operated injection valves	12 <==> 9	(+15°C...+30°C) 0 280 150 208/210: 0 280 150 716: (+80°C) 0 280 150 208/210: 0 280 150 716:	8,20...10,90 Ω 8,00...10,70 Ω	D09
13	 V	19 Resistance of all 3 parallel-connected solenoid-operated injection valves	24 <==> 9		8,7...11,79 Ω 8,5...11,5 Ω	

TEST SPECIFICATIONS

Important!

The Coordinates indicated on the right specifically indicate the section within a trouble-shooting program in which this test is to be found. Afterward, do not continue in this trouble-shooting program, but rather in the test-specifications section or in the trouble-shooting chart.

Pressure regulator

- * Fuel pressure
with engine stopped 2,3...2,7 bar
when idling approx. 0,5 bar less

Electric fuel pump

- * Delivery at return line
2.0l engine: min. 700 cm³/30s
2.3 engine: min. 750 cm³/30s
* Supply voltage under load: min. 12 V
* Delivery of in-tank pre-supply pump min. 800 cm³/30s

Temperature sensor II

- (Engine) plug color blue
* Internal resistance at ambient temperature (+ 15° C...+ 30° C):
up to 08.84: 1,30...3,6 k Ω
as of 09.84: 1,45...3,3 k Ω
Engine at operating temperature (approx.+80°C)
up to 08.84: 250...390 Ω
as of 09.84: 280...360 Ω

Solenoid-operated injection valve

- * Internal resistance at ambient temperature (+ 15° C...+ 30° C):
for solenoid-operated injection valve
0 280 150 208/210: 15,0...17,5 Ω
0 280 150 716: 14,5...17,0 Ω
* Leak rate after 60 s: No droplet
may drip off

Air-flow sensor

- * Electrical internal resistance between:
terms. 8 and 5: 340... 450 Ω
terms. 7 and 5: 60...1000 Ω (+)
terms. 8 and 9: 160... 300 Ω
terms. 9 and 5: 500... 760 Ω

(+)Deflect sensor plate to stop.

Thermo-time switch 35°/8s

Not applicable as of 9.84

* Electrical internal resistance with	Between term. "G" and ground	Between term. "W" and ground	Between terms. "G" and "W"
Ambient temperature (below +30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at operating temperature (above +40°C)	50...80 Ω	100...160 Ω	50...80 Ω

Start valve (not applicable as of 9.84):

- * Electrical internal resistance 3,5...4,5 Ω
* Sealing: Permissible maximum 1 drops/min.

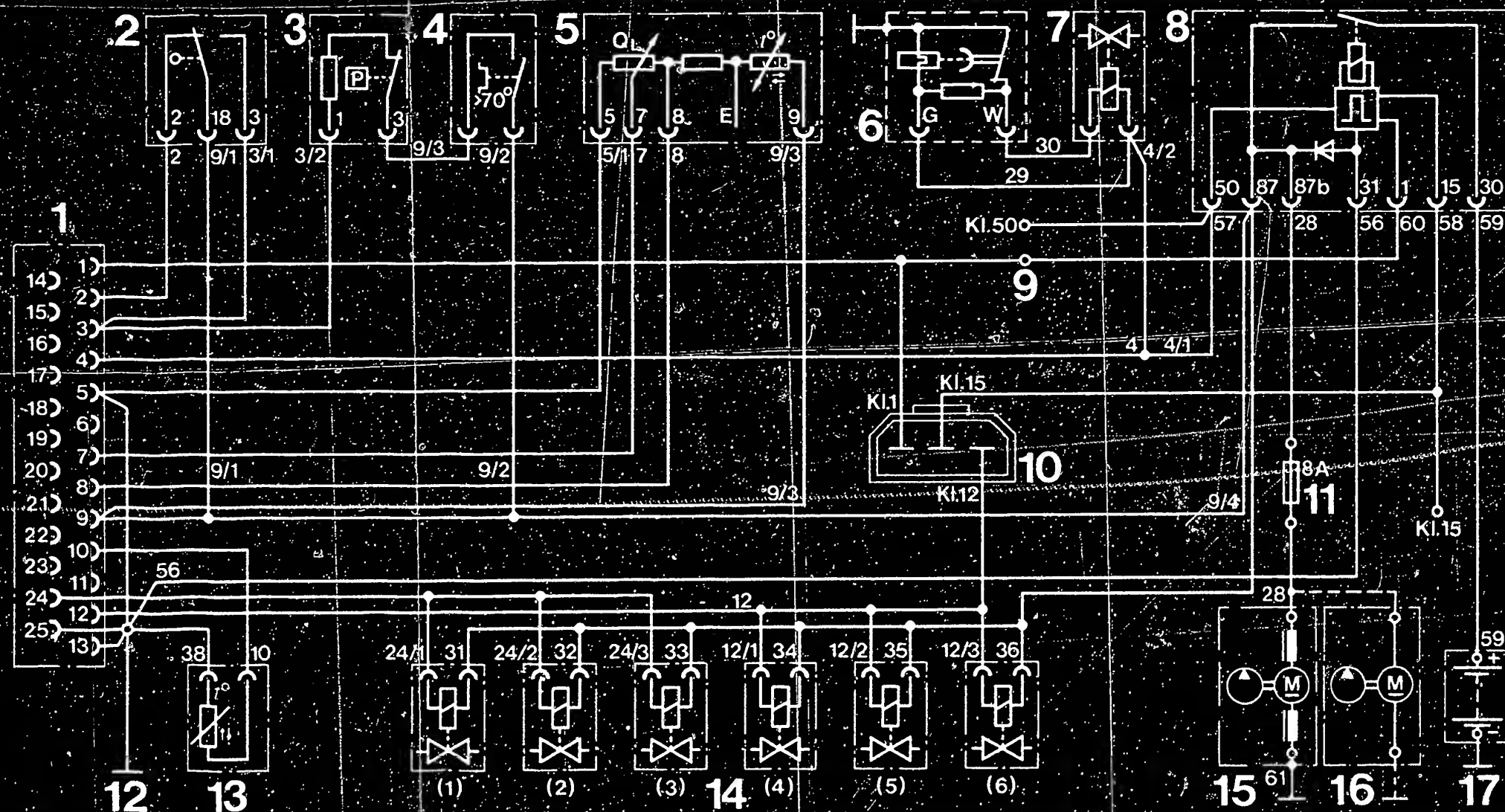
Idle setting (engine at operating temperature, approx. 80° C)

- * Manual and automatic transmission: 750...850 min⁻¹
* CO setting – EU version: < 1,5 vol.% CO
Sweden/Switzerland version: 0,2...0,6 vol.% CO
(Hose connected to air valves).

Setting in case of fault:

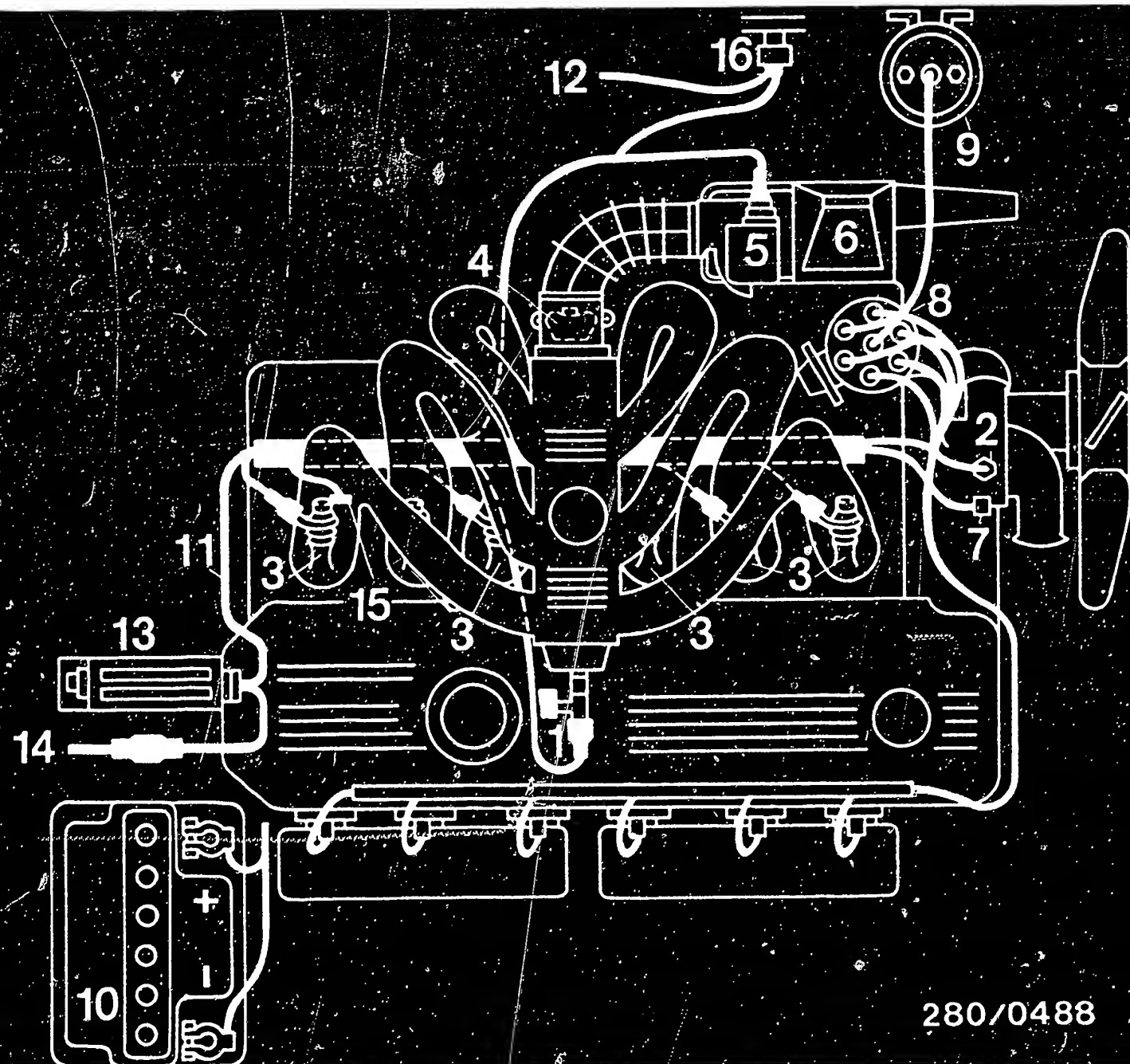
- * CO setting 0,8...1,2 vol.% CO
(with air-valve hose pulled off and blocked)

See equipment and Autodata microcards for settings for ignition, valve clearance and other engine data.



ELECTRICAL TERMINAL DIAGRAM

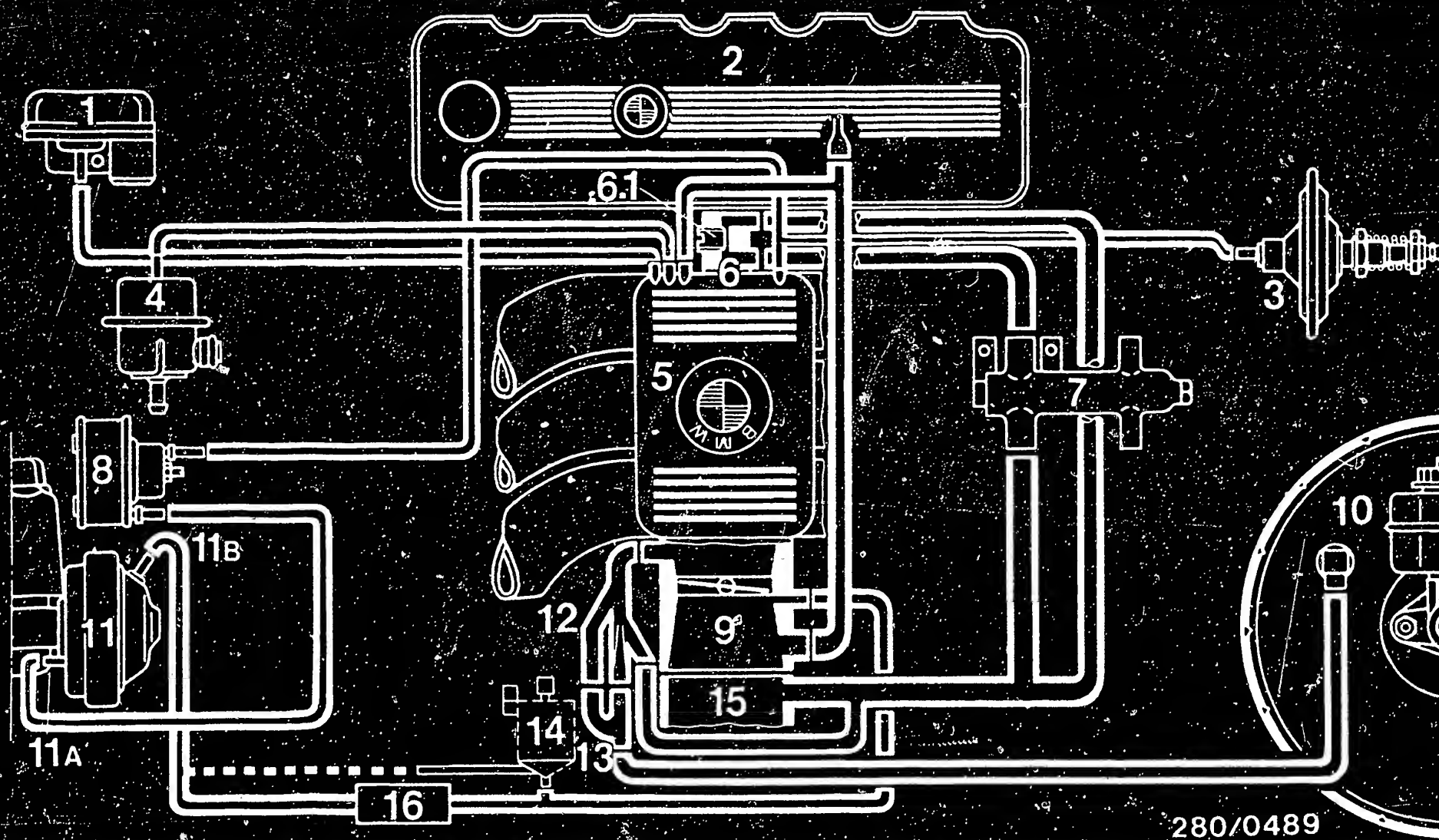
- 1 = Control-unit plug
- 2 = Throttle-valve switch
- 3 = Pressure switch (full-load enrichment)
- 4 = Thermo-switch 70°
- 5 = Air-flow sensor
- 6 = Thermo-time switch
- 7 = Start valve
- 8 = Control relay
- 9 = Term. 1



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ELECTRICAL LEAD DIAGRAM AND ARRANGEMENT OF THE INDIVIDUAL COMPONENTS

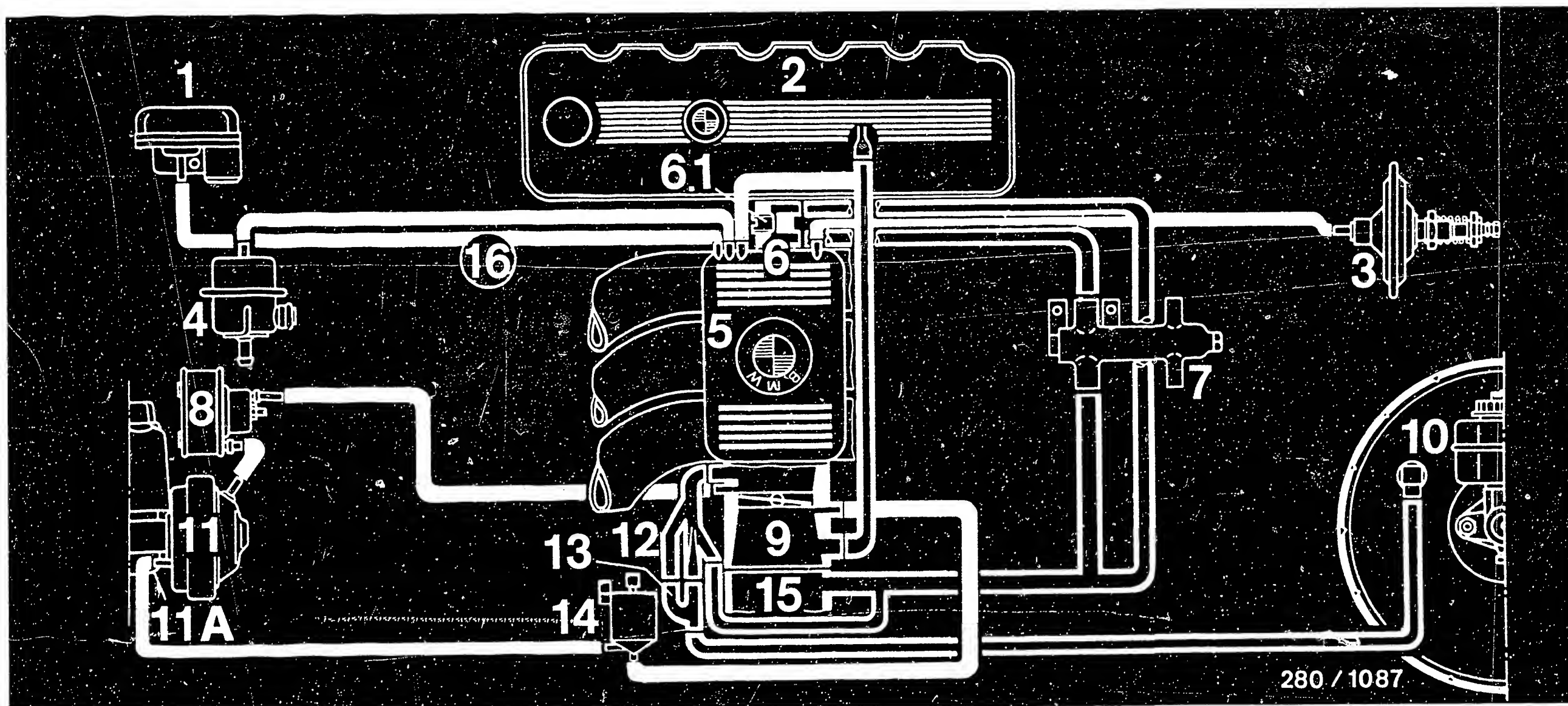
- | | |
|--|--|
| 1 = Start valve (n/a as of 09.84) | 9 = Ignition coil |
| 2 = Thermo-time switch (n/a as of 09.84) | 10 = Battery |
| 3 = Solenoid-operated injection valves | 11 = Jetronic wiring harness |
| 4 = Throttle-valve switch | 12 = Vehicle wiring harness |
| 5 = Air-flow sensor | 13 = Control unit |
| 6 = Air filter | 14 = Plug connection term. 1/term. t D as of 11.84 |
| 7 = Temperature sensor II | 15 = Ground terminals |
| 8 = Ignition distributor | 16 = Control relay |



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AIR-LINE DIAGRAM (Vehicles with damper (16)) 3231 until 1.83, 3201 / 5201 until 02.83

- | | |
|---------------------------------|--|
| 1 = Pressure switch (part load) | 11A = Ignition distributor (vacuum unit) |
| 2 = Cylinder-head hood | 11B = Timing-advance port |
| 3 = Throttle-valve positioner | 12 = Sucking jet pump |
| 4 = Pressure regulator | 13 = Dual non-return valve |
| 5 = Intake manifold | 14 = Solenoid-operated change-over valve |
| 6 = Bypass-air housing | (only Sweden/Switzerland) |
| 6.1 = (Idle-adjusting screw) | for changing spark advance |
| 7 = Auxiliary-air device | 15 = Engine air box |
| 8 = 3/2-way valve | 16 = Damper |
| 9 = Throttle-valve assembly | (Delays ignition advance) |
| 10 = Brake power assist unit | |



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AIR-LINE DIAGRAM 3231 as of 02.83 and 3201 / 5201 as of 03.83

- | | | | |
|-----|---|-----|--|
| 1 | = Pressure switch (part load),
n/a as of 09.84 | 11 | = Ignition distributor (vacuum unit) |
| 2 | = Cylinder-head hood | 11A | = Timing-advance port |
| 3 | = Throttle-valve positioner | 11B | = Timing-retard port |
| 4 | = Pressure regulator | 12 | = Sucking jet pump |
| 5 | = Intake manifold | 13 | = Dual non-return valve |
| 6 | = Bypass-air housing | 14 | = Solenoid-operated change-over valve
(only Sweden/Switzerland)
for changing spark advance |
| 6.1 | = (Idle-speed adjusting screw) | 15 | = Engine air box |
| 7 | = Auxiliary-air device | 16 | = "Interior temperature sensor" connection
for electronic heating control |
| 8 | = 3/2-way valve | | |
| 9 | = Throttle-valve assembly | | |
| 10 | = Brake power assist unit | | |

OVERRUN CUT-OFF DAMPING

on 323i until 01.83 and 320i / 520i until 2.83

To reduce the re-cut-in jolt during overrun operation, the ignition is delayed by vacuum from the intake manifold via a 3/2-way valve and the vacuum unit (delay). After the level has fallen below the respective switching pressure and the re-cut-in of injection switches the 3/2-way valve, the vacuum unit (delay) switches to outside air via a throttle nozzle (on the 3/2-way valve) and the ignition goes into neutral position with a delay period.

* Damper

In acceleration and hence activation of vacuum ignition advance, a damper built into the line to the vacuum unit (advance) ensures that the onset of timing advance is "soft". This damper is required only on vehicles with manual transmission, since the re-cut-in jolt in automatic-transmission vehicles is dampened by the torque convertor and thus is not noticeable.

* 3/2-way valve

Function: Delays ignition retardation in ignition distributor

* Sucking jet pump

Function: Provides for adequate vacuum at brake power assist unit at low engine speeds.

Overrun cut-off damping

and 323i as from 2.83 and 320i / 520i as of 3.83.

In order to improve driving comfort, the following changes to the damping of overrun cut-off have been introduced in vehicles with manual transmission:

- * Reversed operation of the vacuum advance/retard unit on the ignition distributor

- * "Delay" vacuum port on throttle-valve assembly, instead of on intake manifold as previously

- * Altered throttle nozzle in 3/2-way valve.

With the altered overrun cut-off damping, in the overrun phase ignition is delayed by vacuum via the opened 3/2-way valve.

After the level drops beneath the respective switching pressure and fuel injection cuts back in, the 3/2-way valve switches the vacuum unit (retard) to outside air.

Upon re-acceleration, the vacuum timing advance can only come into operation when the priority vacuum unit (retard) has no pressure. Consequently, the damper volume originally required in the "advance" line can be eliminated.

Note!

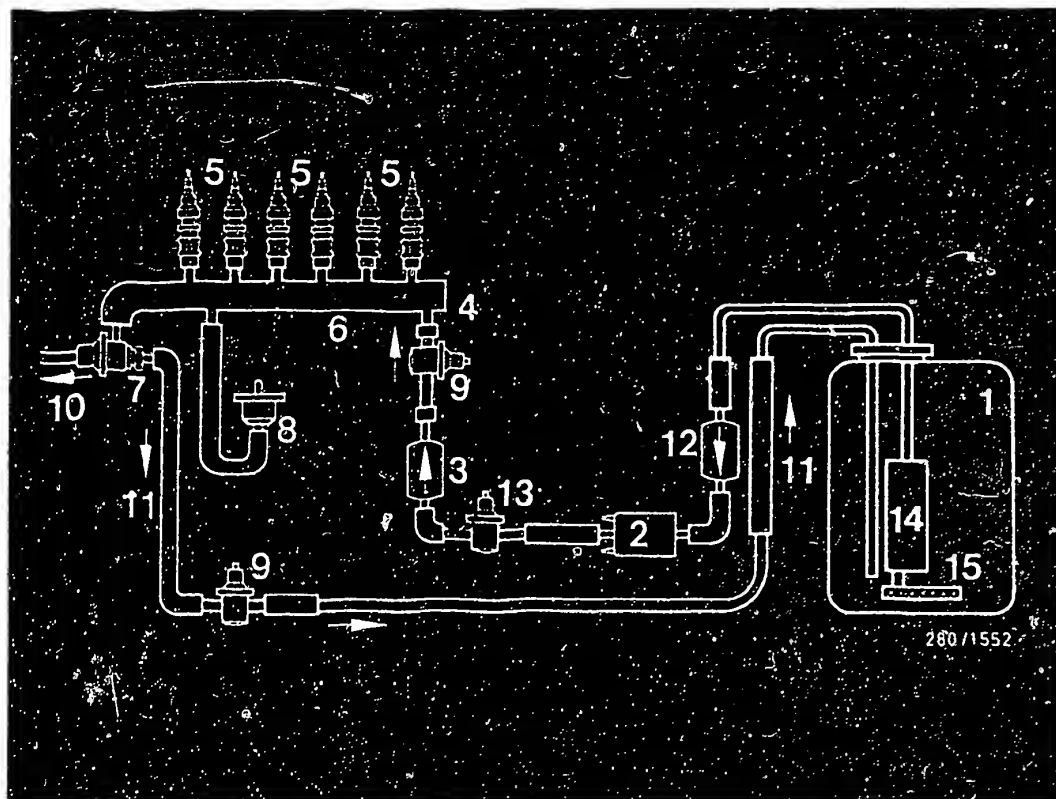
The 3/2-way valve ports must not be mixed up, as this would impair proper functioning of cut-off damping.

Differing nozzles on 3/2-way valve

Engine	Ignition-distributor number	3/2-way valve	Color coding	Nozzle size	Damper volume in the advance line
* 2.3 l - engine					
until 01.83	0 237 302 038	23	blue	50 mm	yes
as of 02.83	0 237 302 040	23	blue	70 mm	no
* 2.0 l - engine					
until 02.83	0 237 302 037	20	yellow	50 mm	yes
as of 03.83	0 237 302 039	20	yellow	70 mm	no

The 3/2-way valves are coded with a color spot on the adjusting screw.

The nozzle diameter can be checked most simply with a 0.60 mm nozzle gauge.



FUEL LINE DIAGRAM

- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Fuel delivery line
- 5 = Solenoid-operated injection valves
- 6 = Fuel-distribution pipe
- 7 = Pressure regulator
- 8 = Start valve
- 9 = Fuel-line-pressure damper
- 10 = Connection to intake manifold
- 11 = Fuel return line
- 12 = Fuel spinner
- 13 = Fuel-line-pressure damper
- 14 = In-tank pre-supply pump (in some cases)
- 15 = Intake strainer

PART-LOAD ENRICHMENT

Installed as of 2.83 in the BMW 323i, as of 3.83 in the 320i, and as of 9.83 in the 520i.

This enrichment is no longer applicable as of 9.84.

The models specified above with manual or automatic transmission are provided with coolant-temperature and intake-manifold-pressure dependent part-load enrichment in accordance with the above dates.

* The part-load enrichment consists of:

- Pressure switch
- Temperature switch (on thermostat housing)
70° C
- Altered engine wiring harness

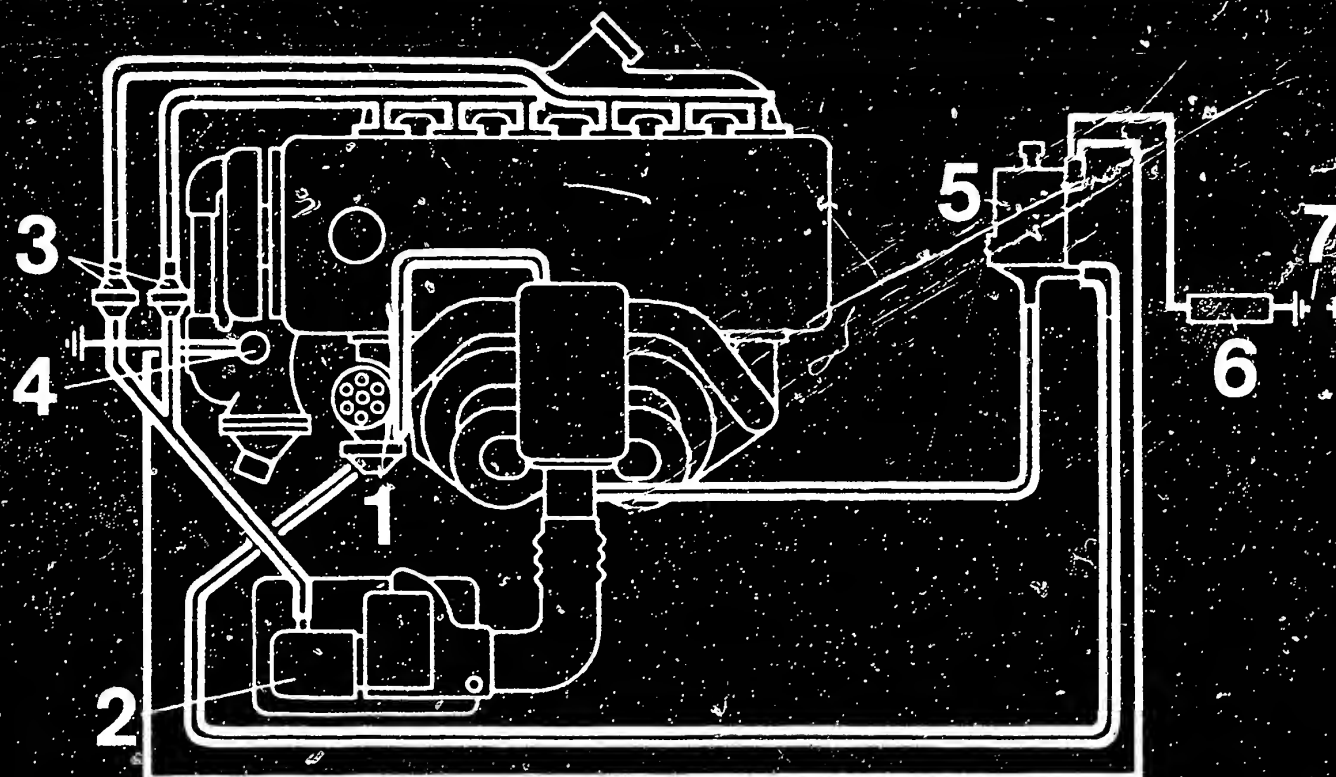
* Function:

Enriching the air-fuel mixture in the part-load range.

* Operation:

Part-load enrichment cuts in when a coolant temperature of 70°C is exceeded and when intake-manifold pressure falls below approx. 200 mbar. If both conditions are reached, the contacts of the pressure switch and the temperature switch close, affecting the full-load contact in the throttle-valve switch. Although the LE control unit receives "enrich" information from the full-load contact, due to the resistance in the pressure switch of approx. 30 k Ω , this information has a reduced input value. This resistance limits the injected quantity to approx. 50 % of the full-load enrichment quantity.

Starting in 9.84, this function is carried out by the control unit (load-dependent part-load enrichment). The pressure switch and temperature switch are eliminated.



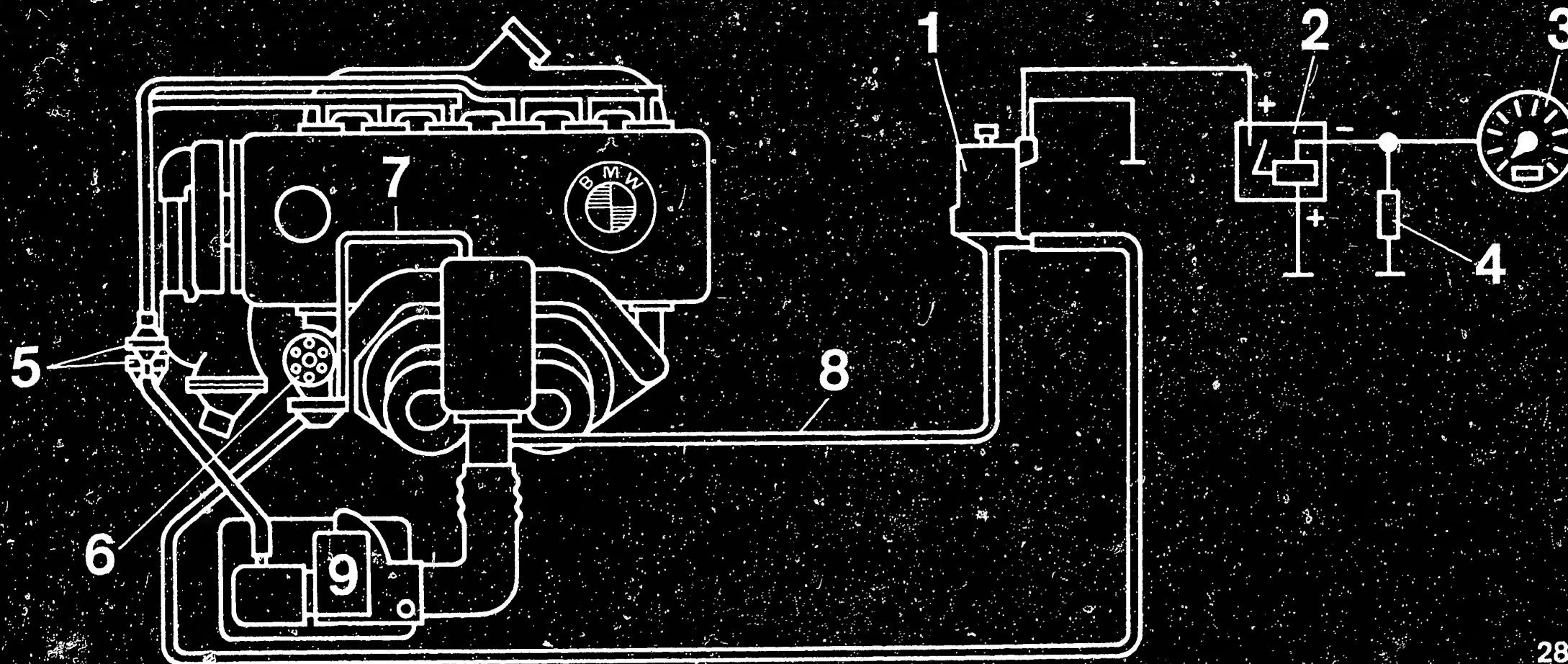
280/0491

- 1 = Ignition distributor
- 2 = Solenoid-operated change-over valve (black)
- 3 = 4th/5th gear switch
- 4 = Timing-advance vacuum (black)
- 5 = Timing-retard vacuum (white)

- 6 = Thermo-switch (timing advance)
continuity above +70°C (n/a as of 6.83)
- 7 = Self-aspirating air valves
- 8 = Battery
- 9 = Air filter

SECONDARY-AIR INDUCTION for BMW 320i/323i - until 5.83 - BMW 520i - until 5.83
(only Sweden, Australia, and Switzerland vehicles).

Fresh air is passed to the exhaust in the exhaust manifold with the air valves, in order to reduce CO and HC values to permissible levels through post-oxidation. For this purpose, the periodic vacuum after the exhaust valves is used to operate the air valves. With the help of this vacuum, the air valves automatically suck filtered intake air into the exhaust manifold, thus contributing to a reduction in pollutants.



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- | | |
|---|-----------------------------------|
| 1 = Solenoid-operated change-over valve | 6 = Ignition distributor |
| 2 = Solenoid-operated change-over relay | 7 = Vacuum timing retard (white) |
| 3 = Speedometer | 8 = Vacuum timing advance (black) |
| 4 = 4th/5th-gear switch (n/a with automatic transmission) | 9 = Air-flow sensor |
| 5 = Self-aspirating air valve | |

Operation of secondary-air induction and vacuum timing advance

Only for Australia/Sweden/Switzerland version BMW 520i (as of 9.83), BMW 320i / 323i (as of 6.83))

* Fresh air is passed to the exhaust in the exhaust manifold with the air valves, in order to reduce CO and HC values to permissible levels through post-oxidation. For this purpose, the periodic vacuum after the exhaust valves is used to operate the air valves. With the help of this vacuum, the air valves automatically-suck filtered intake air into the exhaust manifold, thus contributing to a reduction in pollutants.

* The vacuum timing advance at the ignition distributor is actuated by the solenoid-operated change-over valve. Prerequisite: 4th/5th gear selected (with manual transmission) and speed above 65 km/h.

* Checking self-aspirating air valve:

- Check CO content.
The CO content in the exhaust must always be lower when the hose is connected (between the air valves and air filter) than when the hose is disconnected and blocked.
- Remove air valves.
- Check air valves for leakage by blowing in.
(In the direction of exhaust → passage; in the direction of the air filter the air valves must be completely sealed.)

* Checking 4th/5th gear switch and ignition change-over relay.

- Engine stationary. Ignition "ON"
- Gear switch is in order if the ignition change-over relay switches in 4th/5th gear
(in the 5 series, the relay is located on the central fuse box on the top right, and in front of the control relay in the 3 series).

* Checking vehicle-speed switch and solenoid-operated change-over relay:

- At speeds above 65 km/h, the solenoid-operated change-over relay should switch
(in the 5 series, located on the central fuse box on the lower right beneath the control relay, and between the control relay and the ignition change-over relay in the 3 series).

* Checking solenoid-operated change-over valve (black):

- Engine stationary. Ignition "ON"
- Pull hose from ignition distributor.
- Pull hose at throttle-valve assembly and blow in.

- The solenoid-operated change-over valve switches when 4th/5th gear is selected and the thermo-switch (where present) is bridged to air flow.

- In lower gears or where there is no ground connection there is no air flow.

* Replacing self-inducting air valves

- Loosen hose clamps and pull off hose.
- Unscrew air valves.
- Observe tightening torque! (35...45 Nm)
- Install only air valves with the same designation.

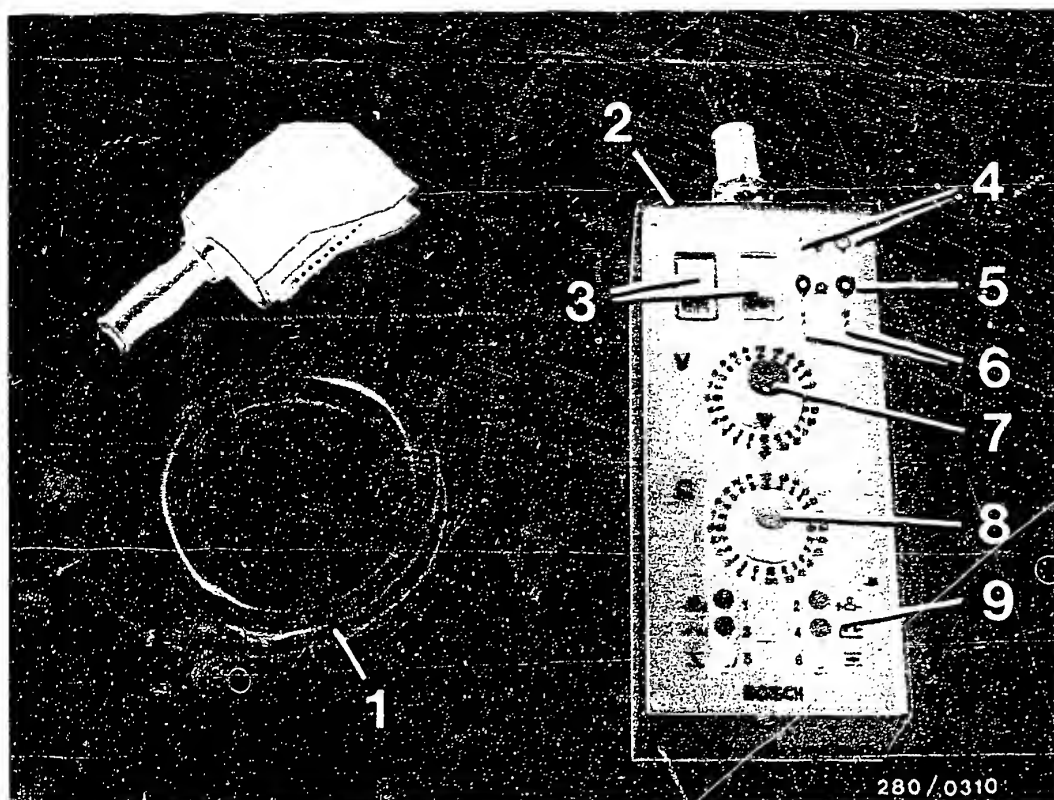
TEST EQUIPMENT AND TOOLS

Description	Designation	Part number
Universal test adapter	ETT 018.01	0 684 101 801
Adapter lead		1 684 463 123
Motortester	e.g. MOT 002.00	0 684 000 200
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Test lead		1 684 463 093
Exhaust-gas tester	e.g. ETT 008.00	0 684 100 800
Calibrated testers	ETT 008.04	0 684 100 804
	ETT 008.05	0 684 100 805
Pressure gauge e.g. manometer	Quality grade 1.0 Measurement range 6 bar Incrementation 0.1 bar	1 687 231 154 KDJE-P 100
Pressure-test. dev. Pressure-test. dev. (no longer available)		KDEP 1034
Three-way lead		KDJE-P 100/13
Electric tester or multimeter e.g.	ETE 014.00	0 684 101 400
	Philips	PM 2517 X
	Miselco	Master 50 K
	Fluke	Multimeter 75
Allen key	AF 5	Commercially available
Solenoid-operated injection valve	until FD 343	0 280 150 208
	as of FD 344	0 280 150 210
	as of 9.84	0 280 150 705
	or	0 280 150 716

Use suitable commercially-available tools to remove and press on the idle-CO anti-tamper device of the air-flow sensor.

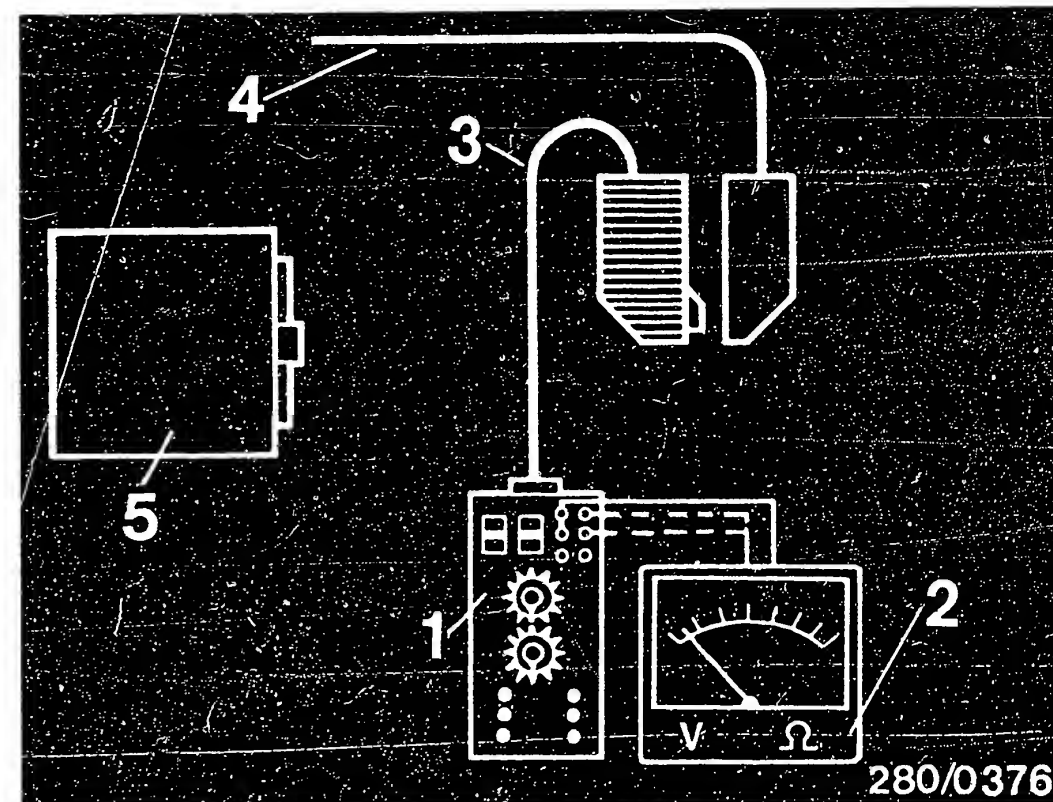
Test equipment and tools (Continued)

Description	Designation	Part No.
Parts set for solenoid-operated injection valve and pressure regulator		1 287 010 704
Vacuum handpump (Mityvac pump)	Korinth Ludwig-Kloos-Str. 21 6450 Hanau 7 (Steinheim) West Germany	
Ignition-coil/ capacitor tester		0 681 100 001
Spark gap	EFAW 1177 / 7	1 684 531 000



UNIVERSAL TEST ADAPTER WITH LE ADAPTER LEAD

- 1 = Adapter lead
(Part no.: 1 684 463 123)
- 2 = Universal test adapter
(Part no.: 0 684 101 801)
- 3 = Test wells (for motortester)
- 4 = Test sockets (for voltage measurements)
- 5 = Test sockets (for resistance measurements)
- 6 = Test sockets (not yet assigned)
- 7 = Program switch " V "
- 8 = Program switch " Ω "
- 9 = Button panel (not used for
LE -Jetronic)



- 1 = Universal test adapter
- 2 = Multimeter
- 3 = LE-adapter lead
- 4 = Jetronic wiring harness
- 5 = LE-control unit

Connection:

Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead.

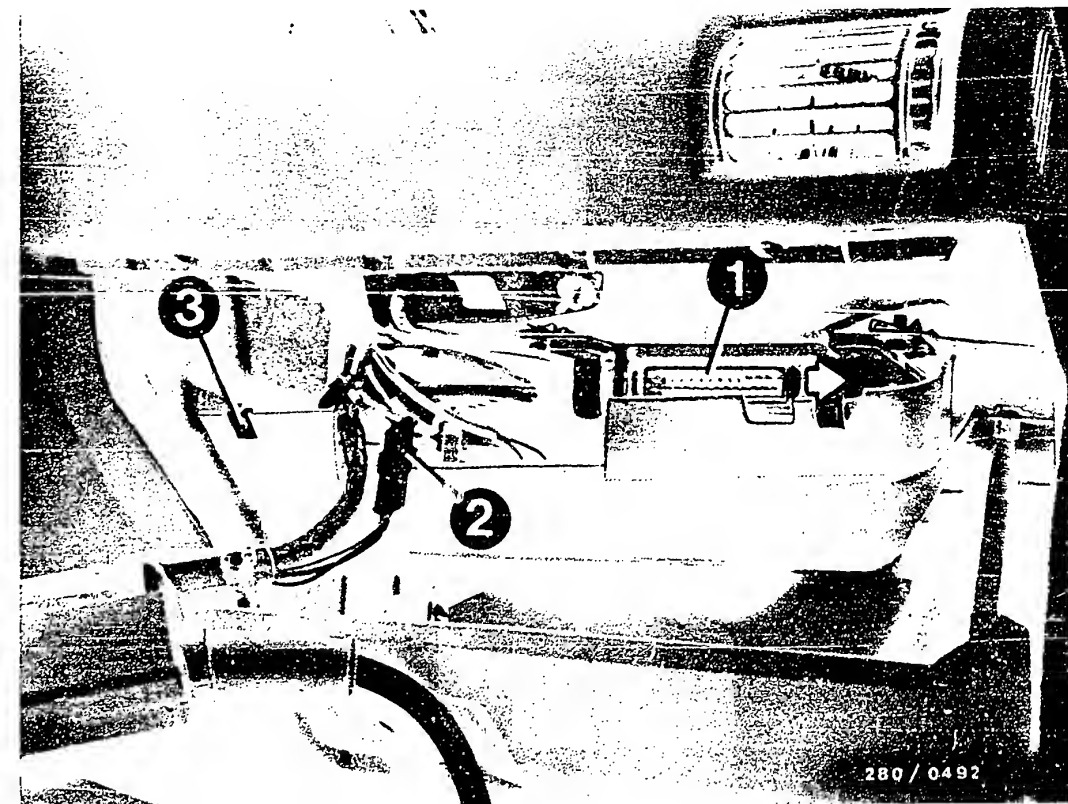
CAUTION !

Connect and disconnect the universal test adapter only with the ignition off:

Testing:

For testing, connect a multimeter with $R_1 = \text{min. } 20 \text{ k } \Omega / \text{V}$ to the test adapter. In addition, the signal from term. 1 of the ignition coil or from term. t_D of the ignition trigger box can be measured with a motortester via the special input.

For production reasons:
continued on the following
coordinate.



3201 / 3231 (5201 similar)

1 = Control unit

2 = Plug connection for term. 1/t D and on-board computer

3 = Fastening screws for control-unit cover

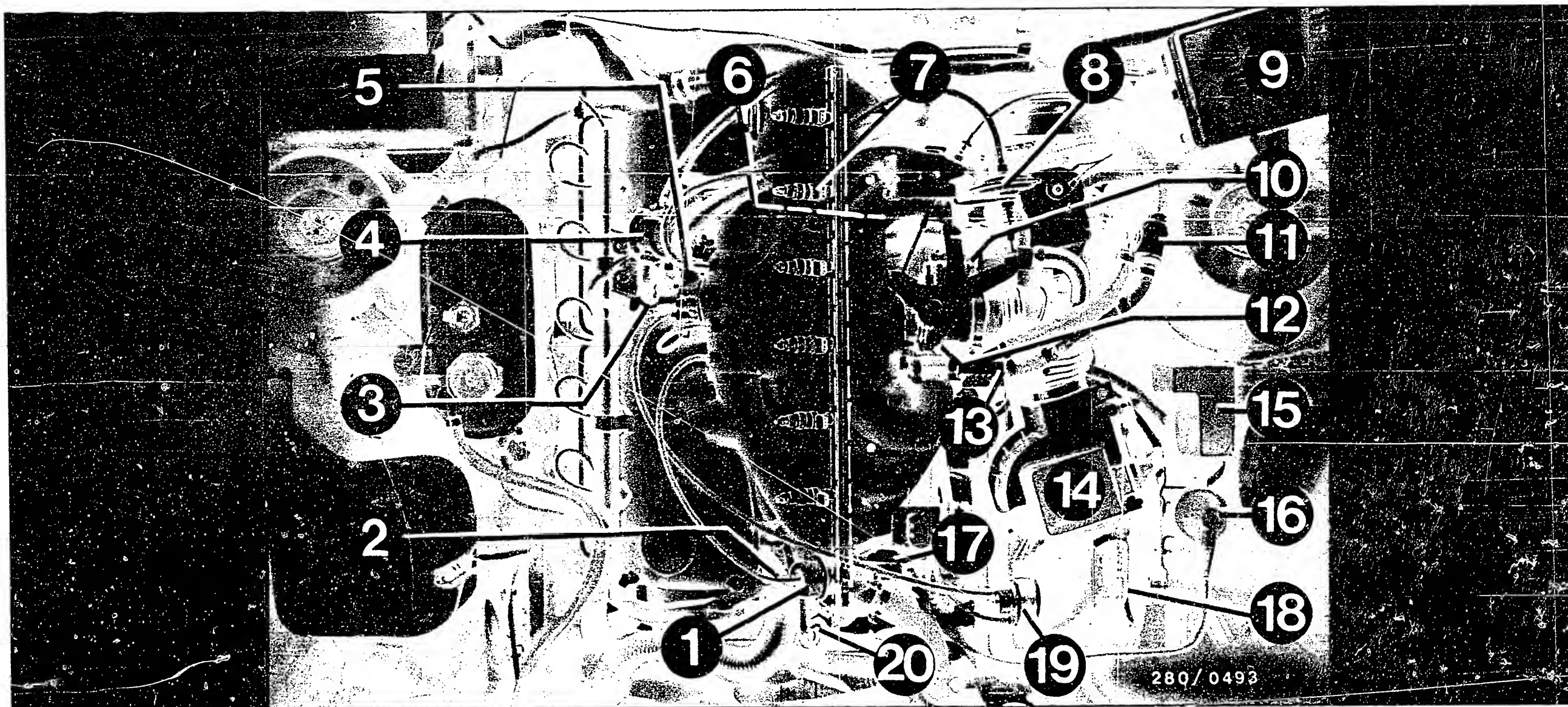
To connect the universal test adapter, unplug the control-unit plug (25 pin). To do this, press detent in direction of arrow.

INSTALLATION POSITION OF COMPONENTS

Position is always in relation to direction of vehicle travel.

Control unit:

The control unit is located in the passenger compartment, on the passenger side in the glove compartment behind covering.



Engine - overall view 323i (320i/520i similar)

- | | |
|--|---|
| 1 = Pressure regulator | 11 = Dual non-return valve |
| 2 = Temperature sensor II (white plug) | 12 = Throttle-valve switch |
| 3 = Start valve (n/a as of 9.85) | 13 = Sucking jet pump |
| 4 = Fuel-line-pressure damper (delivery line) (n/a as of 9.85) | 14 = Air-flow sensor |
| 5 = Idle-speed adjusting screw | 15 = Control relay (under covering) |
| 6 = Ground terminal | 16 = Ignition coil |
| 7 = Solenoid-operated injection valve | 17 = Fuel-line-pressure damper (return line) (n/a as of 9.85) |
| 8 = Throttle-valve positioner | 18 = Air filter |
| 9 = Fuse box | 19 = 3/2-way valve |
| 10 = Auxiliary-air device | 20 = Thermo-time switch (brown plug) |

Pressure switch as of 2.83 BMW 323i
as of 3.83 BMW 320i
as of 9.83 BMW 520i

the pressure switch is deleted as of 9.84:

In engine compartment front left on air filter,
in front of 3/2-way valve.

Fuel filter:

In engine compartment on engine firewall,
near steering rod.

Electric fuel pump:

Beneath vehicle on left in front of rear wheel.

3/2-way valve as of 9.84:

In line from ignition-distributor vacuum
unit to throttle-valve assembly, "hanging".

Ground connection of electric fuel pump:

320i / 323i:
On left beneath rear seat

520i:
On rear-axle support on left, near cable lead-
through grommet for electric fuel pump.

IMPORTANT GENERAL INFORMATION

- * Never start the engine without the battery connected.
- * Do not use a starting aid with more than 16V.
- * Never disconnect battery with engine running.
- * To fast-charge the battery, disconnect it from the vehicle electrical system.
- * Remove the control unit at temperatures above 80°C (paint-drying installation).
- * Make sure that all connectors of the wiring harness are correctly seated.
- * Never disconnect or connect the control-unit plug with the ignition on.
- * When testing compression, cut the power supply by disconnecting the control relay. This prevents undesired injecting.
- * Remove the Jetronic control unit before performing electrical welding work (e.g. spot-welding).
- * If an alarm system is installed, proceed according to SIS microcard "Testing in Vehicle", see KFZ 00..
- * During the following trouble-shooting, it is assumed that engine, ignition and electrical system are O.K.

TROUBLE-SHOOTING CHARTS

Using the universal test adapter with adapter lead (1 684 463 123) and other suitable test equipment, the following trouble-shooting charts are intended to enable the workshop employees to quickly detect causes of trouble on the LE-Jetronic. A choice can be made between the following working procedures, depending on the level of training and experience of the mechanic.

* Detailed, step-by-step trouble-shooting chart

For employees with little practice or experience on LE-Jetronic vehicles.
Each customer complaint is assigned its own complete trouble-shooting program.....

C03

* Direct, pin-pointed trouble-shooting chart

For trained, experienced employees with a great deal of practice on LE-Jetronic vehicles.
For each customer complaint, you start with a specific component of your choice within the trouble-shooting program.....

C05

Both trouble-shooting charts begin by checking the electrical/electronic part of the LE-Jetronic using the universal test adapter with adapter lead. This quickly checks the electrical operation of the wiring harness with the components connected to it, and faults are soon detected.

If no fault is found with the universal test adapter, it is necessary to perform the fuel pressure test.

If once again no fault is found, continue with the detailed o r the direct trouble-shooting chart.

1. Detailed, step-by-step trouble-shooting chart for the complete trouble-shooting program

* Electrical test with universal test adapter, adapter lead 1 684 463 123 and motortester/multimeter

This test must come at the start of the testing program and must be performed from beginning to end (Coordinates C09...D16)

* Fuel pressure test with pressure gauge

This test must come directly after the test with the universal test adapter and must be performed from beginning to end (Coordinates D17...E04)

* Trouble-shooting according to customer complaints (fault symptoms)

The following table contains possible fault symptoms and the right-hand column gives the first coordinate of the relevant detailed trouble-shooting program.

This trouble-shooting program consists of logically ordered test procedures for all individual components of the LE-Jetronic. If, after completing the trouble-shooting program for an assumed symptom, the fault has not been detected or remedied, choose a new fault symptom and work through another program.

<u>Customer complaints</u> (Fault symptoms)	<u>Electrical test with universal test adapter</u>	<u>Fuel pressure test with pressure gauge</u>	<u>Trouble-shooting program</u>
1. Starting motor operates, engine fails to start	C09	D17	E05
2. Engine starts but then dies	C09	D17	F03
3. Rough idle/incorrect idle speed	C09	D17	F11
4. Poor throttle take-up	C09	D17	G23
5. Engine missing under all operating conditions	C09	D17	H19
6. Fuel consumption too high	C09	D17	K11
7. Max. engine power/top speed not reached	C09	D17	L07
8. Idle speed and CO concentration too low or too high	C09	D17	L25

2. PIN-POINT DIRECT TROUBLE-SHOOTING FOR COMPONENTS WITHIN THE TROUBLE-SHOOTING PROGRAM

- * Electrical testing with the universal test adapter, adapter lead, 1 684 463 123 and motortester or multimeter
Testing with the universal test adapter must come at the beginning of the test program and must be carried out from beginning to end. (Coordinates C09...D16).
- * Fuel-pressure test with pressure gauge
Fuel-pressure testing must immediately follow testing with the universal test adapter, and must be carried out from beginning to end (Coordinates D17...E04).
- * Trouble-shooting according to customer complaint
The table below contains various symptoms of trouble with several possible causes for each. The coordinate reference field shows the first coordinate of the test sequence for the LE-Jetronic component concerned. If, after testing the individual component, the fault has not been located or rectified, a new symptom of trouble must be determined.

Customer complaint (Symptom of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty								
2. Engine starts but then dies								
3. Rough idling, incorrect idle speed								
4. Poor throttle response								
5. Engine missing under all operating conditions								
6. Excessive fuel consumption								
7. No maximum engine power								
8. Idle speed CO concentration too low or too high								
Cause (Component defect)								
C09	C09	C09	C09	C09	C09	C09	C09	Mistake in electric testing with universal test adapter
D17	D17	D17	D17	D17	D17	D17	D17	Fault in fuel supply: (Check control relay, pump fuse, electric fuel pump, fuel pressure, and pressure regulator.) Fuel pressure does not remain constant.
E19	F07		H01					Auxiliary-air device fails to open
		F21					M03	Auxiliary-air device fails to close
E21		G11	H01	H23	K27	L15	M05	Air-flow sensor defective, test potentiometer (noise test)
E25								Coughing during starting
E13		F25						Thermo-time switch defective (n/a as of 09.84)
F01	F09	G15	H11			L21	M21	Leakage in air-induction system
		F27		J23	K17	L19	M11	Solenoid-operated injection valves defective, repair, sealing, connect test lead
E07								Start valve fails to open (n/a as of 09.84)
E11	F05	F23			K13		M09	Leakage in start valve (n/a as of 09.84)
				J03		L11		Insufficient delivery quantity from electric fuel pump
			H09	K05	K15			Pressure switch (part-load enrichment) defective
		F15	G27					Throttle plate fails to close, throttle-valve posit., throttle-valve switch (adjust.)
						L09		Throttle plate does not open completely
				J11				Overrun cut-off defective

Customer complaint (symptom of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Rough idling, incorrect idle speed
4. Poor throttle response
5. Engine missing under all operating conditions
6. Excessive fuel consumption
7. No maximum engine power
8. Idle speed and CO concentration too low or too high

Cause (component defect)

			H21				Open circs. in wiring harness and plug connections, interfer., missing, ground contact
			J17				3/2-way valve defective
	F17	H15		L03		L27	CO-exhaust setting too rich, idle setting
	F17	H15	J07				CO-exhaust setting too lean, idle setting, coughing
			J07				Control unit defective
E15						M13	Start control (as of 09.84)
			J21				Test functioning of solenoid-operated injection valve

TEST CHART FOR UNIVERSAL TEST ADAPTER

with adapter lead 1 684 463 123

for LE-Jetronic

- * Before testing with the universal test adapter, check all multiple plug connections for loose contacts. Clean contacts if dirty or corroded.
- * Watch for blade receptacles that have been pushed back. If necessary, bend back locking tab and press blade receptacle as far as it will go into plug housing; locking tab latches.
- * Suspicion of line breaks in case of kinking and pinching.

The universal test adapter tests only the peripherals of the electrics (not including control unit).

Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead (ignition must be off).

To make the readings, connect a multimeter to the universal test adapter for voltage and resistance measurements, as well as a motortester.

The individual test steps are selected by means of two program switches (one for voltage measurements, the other for resistance measurements). Each program switch has 24 test settings, only some of which, however, are used for the LE-Jetronic.

The test with the universal test adapter must always be performed from the beginning to end, starting at test step 1, and in the given sequence.

Be sure to follow the instructions in the test chart!

- * Test steps 1...3 measure voltages during starting.

Set multimeter to "voltage measuring range".

- * Test steps 4...12 measure resistances.

Set multimeter to "resistance measuring range".

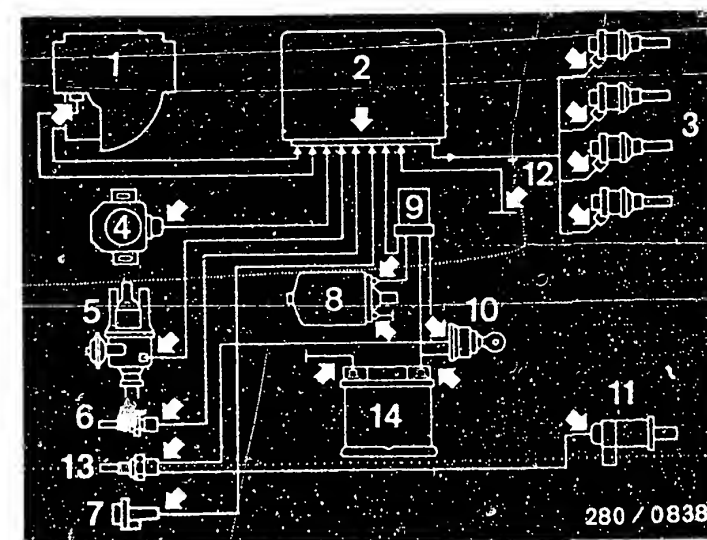
Test specifications and notes on how to operate the universal test adapter are given in the following test chart.

Requirements for correct testing procedure:

1. The trouble-shooting in each test step builds on the trouble-shooting of the preceding test step.
Example: If, in test step 1, the ground connect term. 5 for the control unit is checked, this is not repeated in the following test steps.
2. If an incorrect reading is indicated for a test step, this test step must be repeated after the fault has been remedied.

Note:

In the following test steps, a frame is drawn around certain passages of text to indicate which operation has to be changed compared with the preceding test step.



Electric plug connections
(arrows)

- 1 = Air-flow sensor
- 2 = Control unit
- 3 = Solenoid-operated injection valves
- 4 = Throttle-valve switch
- 5 = Ignition distributor
- 6 = Temperature sensor (engine)
- 7 = Auxiliary-air device
- 8 = Electric fuel pump
- 9 = Control relay
- 10 = Ignition lock
- 11 = Start valve
(n/a as of 9.84)
- 12 = Central ground
- 13 = Thermo-time switch
(n/a as of 09.84)
- 14 = Battery

TEST STEP 1	(TEST SPECIFICATIONS AND NOTES ON OPERATION)
-------------	--

V

Component / Operation

Until 8.84:

Term. 1 signal from ignition trigger box term. 16.

As of 9.84:

t_p signal from ignition trigger box term. 4.

Drive of control unit.

* Operation:

Programm switch "V"

Program switch " Ω "

Test button

1) Any switch position.

Position

5
1)
—

* Measuring equipment:

Ignition oscilloscope

* Measuring range:

Special input

Control-lever left stop

Measuring range 20 V

* Connection: Test inlets

* Operation in vehicle:

Ignition "on" and start

* Test specifications (reading):

Until 8.84:

Primary signal present (see upper illustration)

As of 9.84:

t_p signal present (see middle illustration).

N>

V

V

Continued on next coordinate

* Trouble-shooting

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary.

Test following leads for continuity using ohmmeter (nominal value 0 Ω)

3201 / 3231 (until 8.84):

- * From control-unit plug term. 1 to control relay term. 1.
- * From control relay term. 1 to ignition trigger box term. 16.
- * From control-unit plug term. 5 to output stage ground terminal.

5201 (until 8.84)

- * From control-unit plug term. 1 to diagnostic connection term. 13.
- * From diagnostic connection term. 13 to control relay term. 1.
- * From control relay term. 1 to ignition coil term. 1.
- * From control-unit plug term. 5 to output stage ground terminal.

V

V

Continued on next coordinate

261/0212

28070831

280/0314

C11	C12	<=>
-----	-----	-----

V

3201 / 3231 and 5201
 (as of 9.84)

- * From control-unit plug term. 1 to plug connection for vehicle wiring harness term. t_D.
- * From control-unit plug term. 1 to control relay term. t_D and ignition trigger box term. t_D (term. 4)
- * From control-unit plug term. 5 to electronics ground terminal.
- * Eliminate contact resistances in plug connections.

If the ignition-impulse reading is still not present → check ignition system.

Installation position of components
Ground terminal: In engine compartment on left, near auxiliary-air device.
Ignition trigger box, 3 series:
 On the right on engine firewall
Ignition trigger box, 5 series:
 On left in engine compartment above ignition coil.
Control relay, 3 series:
 In engine compartment on left inside fender under a covering.
Control relay, 5 series:
 On fuse box, right.
Diagnostic connection: In engine compartment, front center under a red closure cap.

V

Continued on next coordinate	
------------------------------	--

Component/Function:

Control unit power supply from
term. 87 of control relay.

* Operation:	Setting
Progr. switch "V"	6
Progr. switch "Ω"	—
Test button	—

* Measuring equipment:
Motortester/multimeter

* Measuring range:
0 ... 15 V

* Connection:
Red test socket (+)
Black test socket (-)

* Operation in vehicle:
Ignition "ON" and start

* Test specification (reading):
8...15 V

Is reading within test specification tolerance?

N>

* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary. Test the following leads for continuity using ohmmeter (nominal value 0 Ω):

* From control-unit plug term. 9 to control relay term. 87

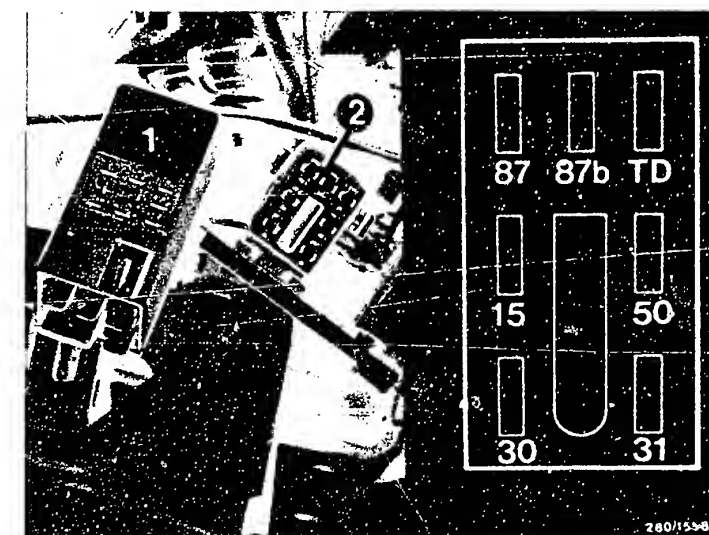
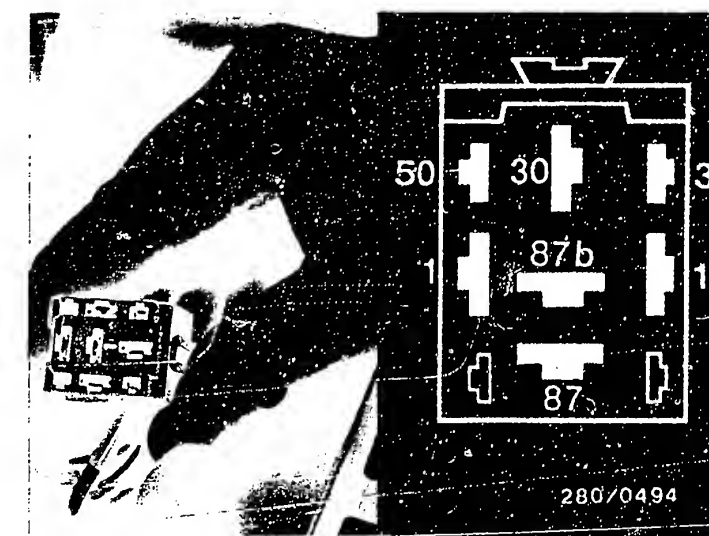
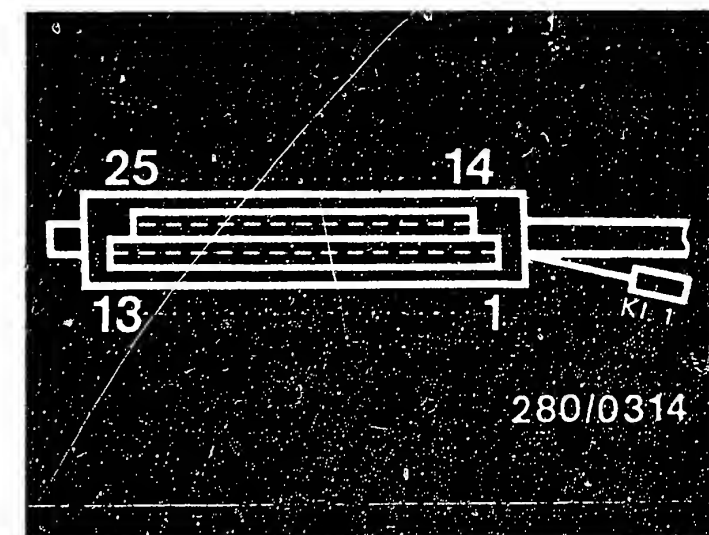
* Check voltage supply via control relay term. 15.

* From control relay term. 30 to battery (positive)
C A R E F U L !
Disconnect battery.
Eliminate contact resistances in plug connections, or replace control unit.

Upper illustration:
Top view of control-unit plug.

Middle illustration:
(until 8.84)
Control relay pulled. Top view of plug.

Lower illustration:
(as of 9.84)
1 = Control relay
2 = Top view of connection base



Continued on next coordinate

V

Component / Function:

Starting signal at control unit from term. 50 of ignition and starting switch.

* Operation:

Progr. switch " V "	7
Progr. switch " Ω "	
Test button	

* Measuring equipment

Motortester/multimeter

* Measuring range:

0 ... 15 V

* Connection:

Red test socket (+)

Black test socket (-)

* Operation in vehicle:

Ignition "ON" and start

* Test specification (reading):

8...15 V

Is reading within test specification tolerance?

N>

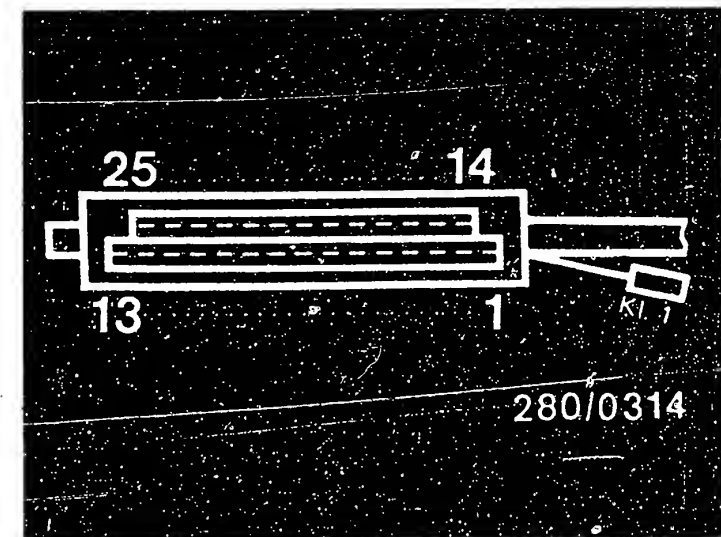
* Trouble-shooting

For testing, disconnect control-unit plug from test adapter and use circuit diagram where necessary.

Check following leads for continuity using ohmmeter (nominal value 0 Ω):

* From control-unit plug term. 4 via a collection point to starting motor term. 50.

* Eliminate contact resistances in plug connections.



Top view of control-unit plug

Y

V

Continued on next coordinate

Component/Operation:

Resistance from air-flow sensor
term. 8 to ground terminal output
stage

N>

* Operation:	Position
Program switch "V"	==>
Program switch "Ω"	11
Test button	

* Measuring equipment:
Motortester or multimeter

* Measuring range:
x 10 Ω

* Connection:
Blue test jacks

* Operation in vehicle:
None

* Test specification (reading):
100 ... 200 Ω

Is measured value within test-
specification tolerance?

* Trouble-shooting:

For testing, disconnect control-
unit plug from test adapter, and
use circuit diagram when necessary.

Test following leads for continuity
using ohmmeter (nominal value 0 Ω):

Air-flow sensor

* From control-unit plug term. 8.
to air-flow sensor term. 8

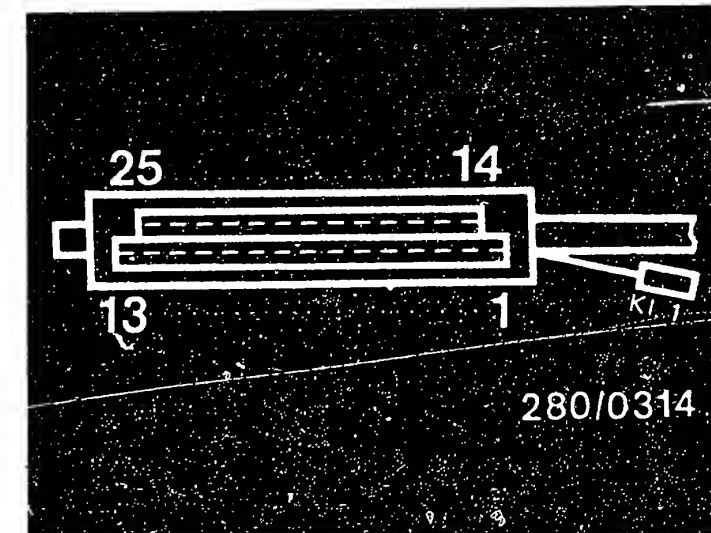
* From air-flow sensor term. 5 to
control-unit plug term. 5.

Electric fuel pump

* From control relay term. 87b via
pump fuse (in fusebox no. 11 in
the 3 series and no. 1 in the 5
series) to electric fuel pump
(positive connection).

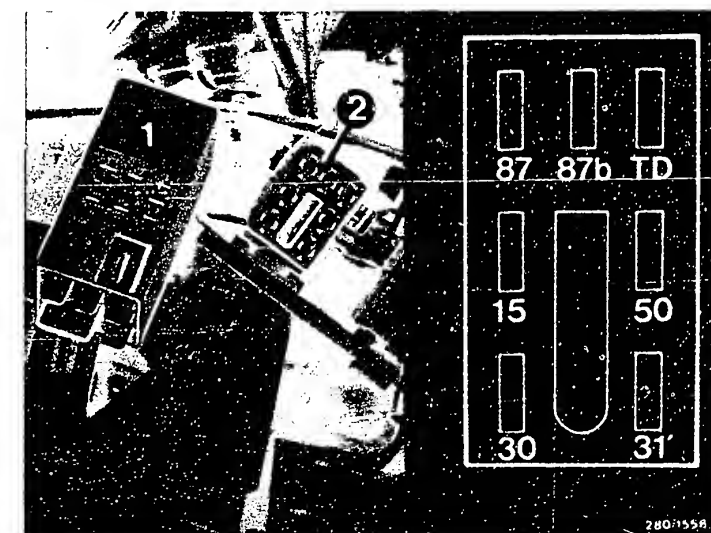
* From electric fuel pump (negative
connection) to vehicle-body ground
connection (320i /323i beneath rear
seat on left, 520i on rear-axle
support near cable lead-through
grommet for electric fuel pump).

* Eliminate contact resistances in
plug connections.



Top view of control-unit plug

1 = Control relay
2 = (Top view of connection base)
(520i similar until 8.84.)

Installation position of componentsAir-flow sensor

On left in engine compartment.

Electric fuel pump:

3 series: On left in front of rear
wheel.

5 series: On right in front of rear
axle.

Continued on next coordinate

V

Component/Operation:

Resistance from air-flow sensor (potentiometer) term. 7 to ground terminal output stage

N>

* Operation:

Program switch "V"	==>
Program switch "Ω"	12
Test button	

* Measuring equipment

Motortester or multimeter

* Measuring range:

x 10 Ω

* Connection:

Blue test jack

* Operation in vehicle:

Fully deflect sensor plate

* Test specification (reading):

60 ... 1000 Ω

Is measured value within test-specification tolerance?

V

Continued on next coordinate

* Trouble-shooting

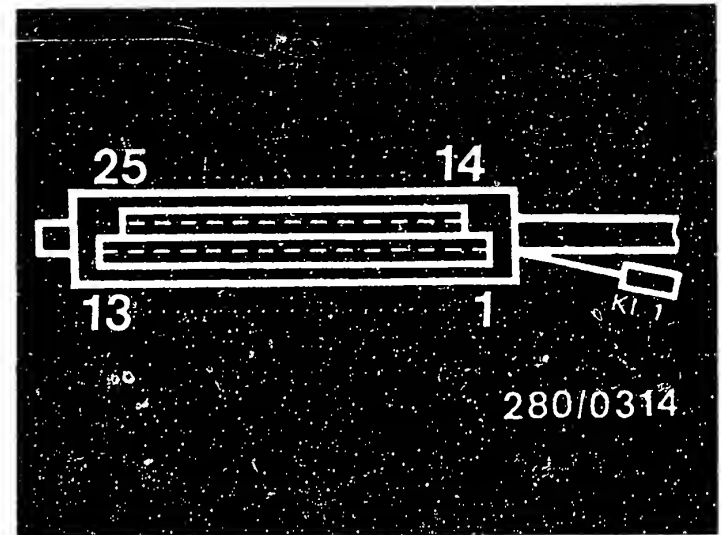
For testing, connect control-unit plug from test adapter, and use circuit diagram when necessary.

Test following leads for continuity using ohmmeter
(Nominal value approx. 0 Ω):

* From control-unit plug term. 7 to air-flow sensor term. 7.

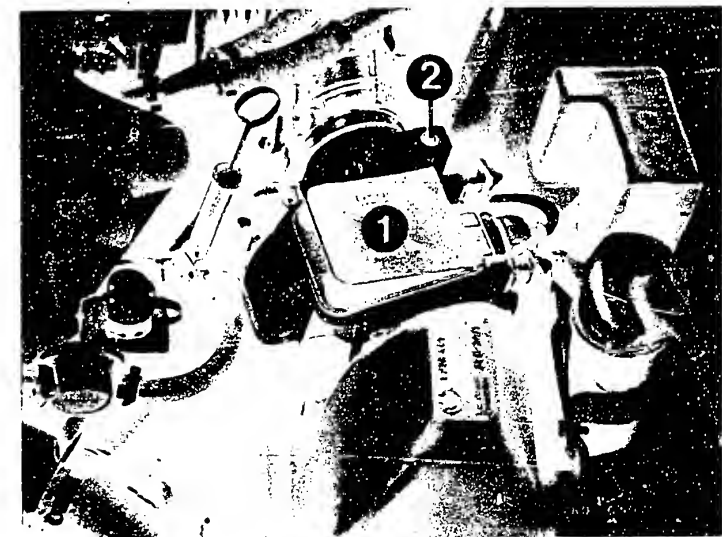
* From air-flow sensor term. 5 to control-unit plug term. 5.

Eliminate contact resistances at plug connections.



Top view of control-unit plug

320i / 323i, (520i similar)
 1 = Air-flow sensor
 2 = CO adjusting screw



Component/Operation:

Resistance from temperature sensor II (engine) term. 10 to output stage ground terminal

N>

* Operation:

Position

Program switch "V"	==>
Program switch "Ω"	13
Test button	

* Measuring equipment

Motortester or multimeter

* Measuring range:

x 10 Ω or x 100 Ω

* Connection:

Blue test jacks

* Operation in vehicle:

None

* Test specifications (reading):

At ambient temperature (+15°C ... +30°C), measuring equipment should show:

Until 8.84: 1,3...3,6 k Ω

As of 9.84: 1,45...3,3 k Ω

and with engine at operating temperature (approx. +80°C):

Until 8.84: 250...390 Ω

As of 9.84: 280...360 Ω

* Trouble-shooting

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary.

Resistance directly at engine-temperature sensor (until 8.84 white plug, as of 11.84 blue plug) (lower illustration - arrow)

Until 8.84

Ambient temperature

(+15°C...+30°C)

1,3...3,6 k Ω

Engine at operating temperature (+80°C):

250...390 Ω

As of 9.84:

Ambient temperature

(+15°C...+30°C):

1,45...3,3 k Ω

Engine at operating temperature (+80°C):

Ω

Test the following leads for continuity using ohmmeter

(Nominal value approx. 0 Ω):

* From control-unit plug term. 10 to temperature sensor II (engine)

* From temperature sensor term. 38 to output stage ground terminal (as of 9.84, electronics ground terminal).

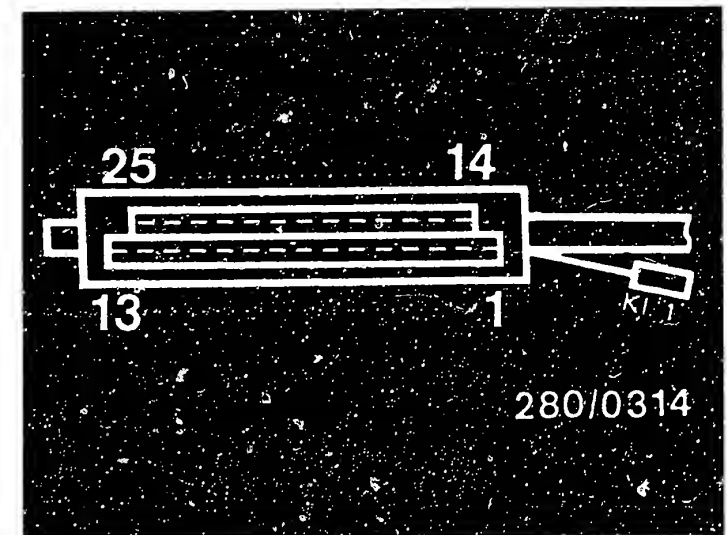
* Eliminate contact resistances in plug connections.

Installation position of components

Output stage ground terminal,

electronics ground terminal:

Left on engine block above auxiliary-air device.



Top view of control-unit plug

Arrow = Temperature sensor II (engine)



Continued on next coordinate

Component/Function:

Ground connection of output stage, control unit term. 13.

* Operation:	Setting
Progr. switch " V "	=>
Progr. switch " Ω "	14
Test button	

* Measuring equipment
Motortester/multimeter

* Measuring range
x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specification (reading)
0...10 Ω

Is reading within test specification tolerance?

N>

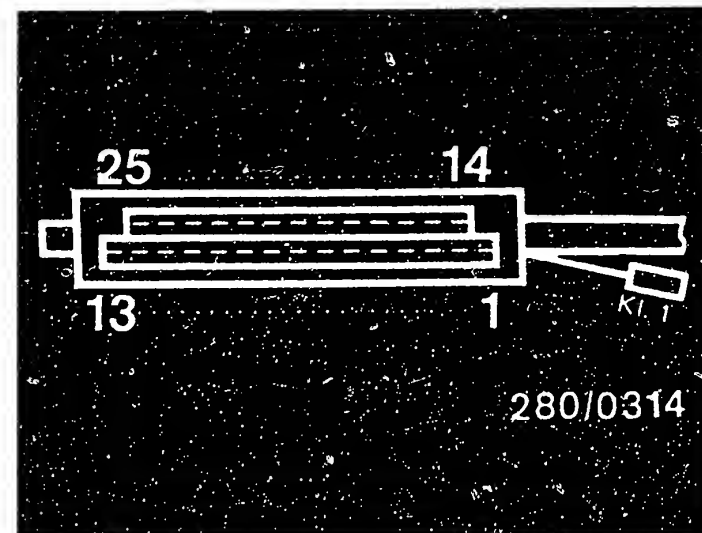
* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary.

Test following leads for continuity using ohmmeter (nominal value approx. 0 Ω):

* From control-unit plug term. 1 to output stage ground terminal.

Eliminate contact resistances at plug connections.



Top view of control-unit plug

Installation position of components

Output stage ground terminal:
Above auxiliary-air-device mounting,
at left on engine.

Continued on next coordinate

V

Component/Operation:

Ground connection of output stage.
Ground connection from control unit
term. 25 and 5.

N>

* Operation:

Position:	
Program switch "V"	⇒
Program switch "Ω"	15
Test button	

* Measuring equipment:

Motortester or multimeter
(Ω range)

* Measuring range:

x 1 Ω

* Connection:

Blue test jacks

* Operation in vehicle:

—

* Test specification (reading)

0 ... 10 Ω

Is measured value within test-specification tolerance?

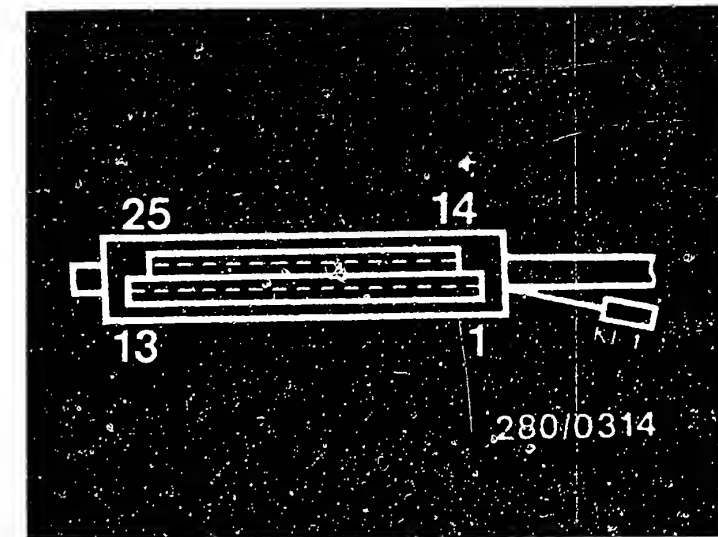
* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary.

Test following leads for continuity using ohmmeter (nominal value approx. 0 Ω):

* From control-unit plug term. 2 to output stage ground terminal.

Eliminate contact resistances at plug connections.



Top view of control-unit plug

Y

Continued on next coordinate

V

Installation position of components

Output stage ground terminal:

Above auxiliary-air-device mounting,
at left on engine.

Component/function:

Throttle-valve switch
(idle contact).

Resistance value at control-unit plug between term. 2 and term. 9.

N>

Operation:Position

Prog.-selec. switch "V"	=>
Prog.-selec. switch "Ω"	16
Test button	

* Measuring equipment

Motortester or multimeter
(Ω range)

* Measuring range:

x 1 Ω

* Connection:

Blue measuring sockets

* Operation in vehicle:

Accelerator pedal in idle position, "suck" back throttle-valve actuator (Mityvac pump).

* Test specification (reading):

0...10 Ω

Is value measured within test-specification tolerance?

* Trouble-shooting

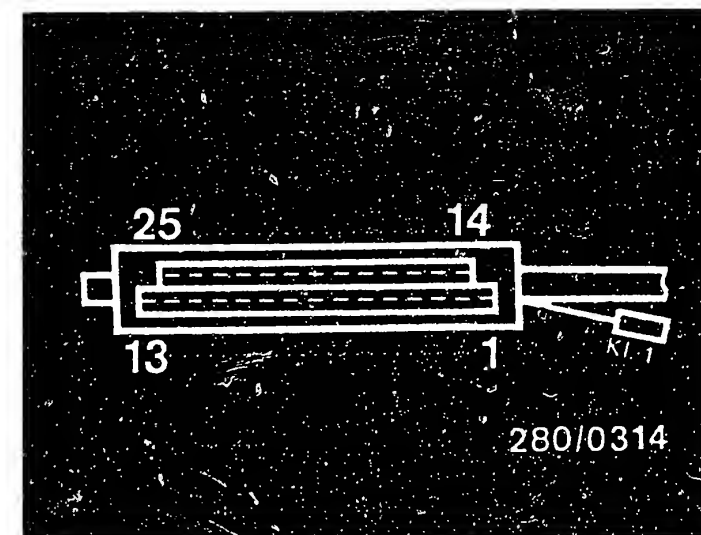
For testing, disconnect wiring-harness plug from test adapter, and use circuit diagram when necessary.

Testing throttle-valve switch
(beneath throttle-valve assembly):

Apply pressure to throttle-valve positioner with Mityvac pump until throttle-plate lever no longer rests on throttle-valve positioner. Loosen the fastening screws of the throttle-valve switch somewhat. Connect ohm-meter at throttle-valve switch between term. 2 and lead 9 (term. 18). Turn throttle-valve switch to the right until the idle contact (microswitch) clicks audibly (reading 0 Ω).

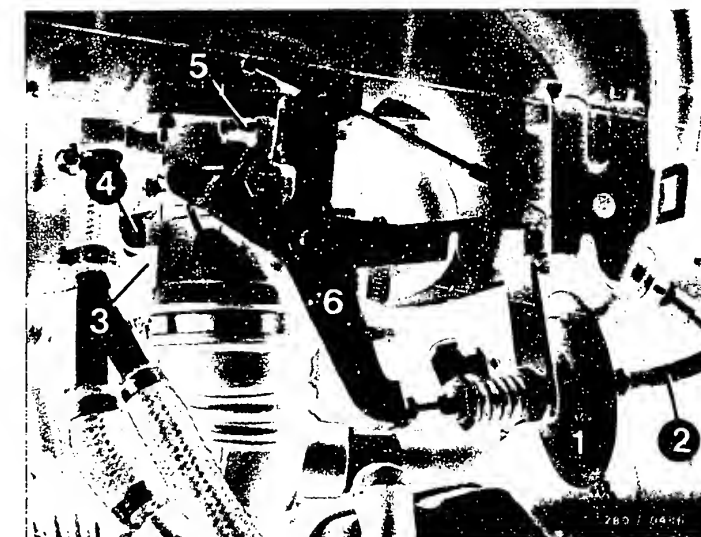
Adjustment check:

Pull slightly on accelerator cable. The idle contact (microswitch) should click audibly (reading infinite Ω).



Top view of control-unit plug

- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Throttle-valve switch
- 4 = Fastening screws
- 5 = Throttle-valve stop screw
- 6 = Throttle-plate lever



Continued on next coordinate

Continued on next coordinate

Adjusting the throttle-valve positioner (1)

- * Pull the vacuum hose from throttle-valve positioner.
- * Set spring dimension B = 32.7 ... 33.3 mm using nut (3).
- * Set positioning dimension A = 2.6 ... 3.0 mm using screw (4).
Dimension A is measured between the throttle-plate lever and the idle stop screw (5).

After adjustment, reconnect the vacuum hose.

Check the following leads for continuity using ohmmeter

(Nominal value approx. 0 Ω):

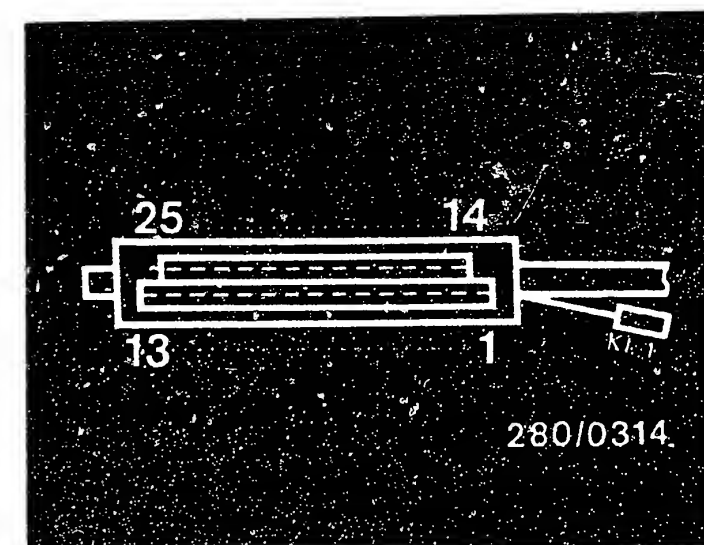
- * From control-unit plug term. 2 to throttle-valve switch term. 2.
- * From throttle-valve switch lead 9 to control unit plug term. 9.

Eliminate contact resistances in plug connections.

Installation position of components:

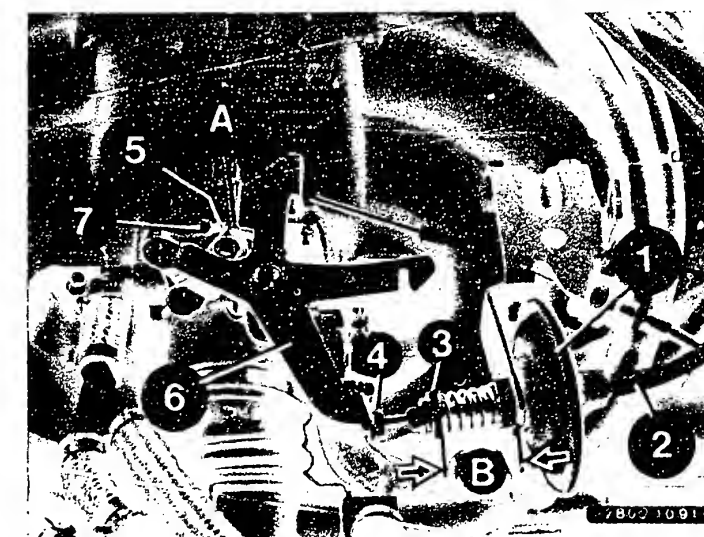
Throttle-valve switch:

In engine compartment, in center beneath the throttle-valve assembly.



Top view of control-unit plug

- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Nut
- 4 = Bolt
- 5 = Throttle-valve stop screw
- 6 = Throttle-plate lever
- A = Setting dimension 2.8 ± 0.2 mm
- B = Spring dimension 33 ± 0.3 mm



Component/function:Throttle-valve switch
(full-load contact)Resistance value at control-
unit plug between term. 3 and
term. 9

N>

* Operation:Position

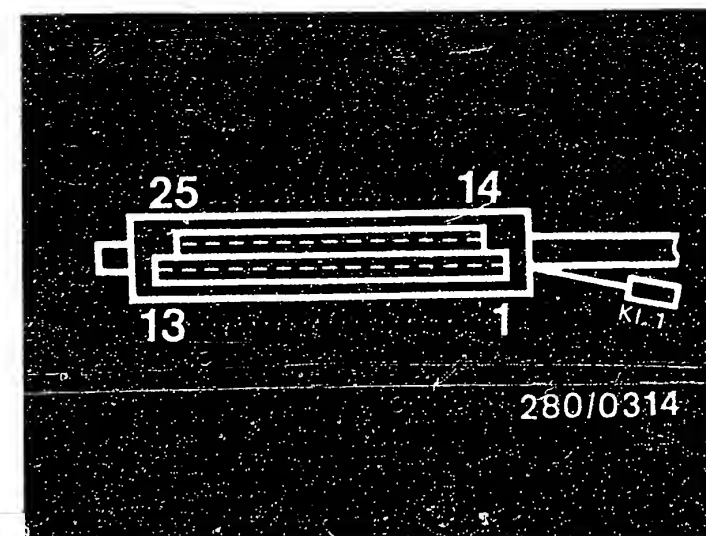
Prog.-selec.switch " V "	==>
Prog.-selec.switch " Ω "	17
Test button	

* Measuring equipment:Motortester or multi-
meter* Measuring range:x 1 Ω * Connection:

Blue measuring socket

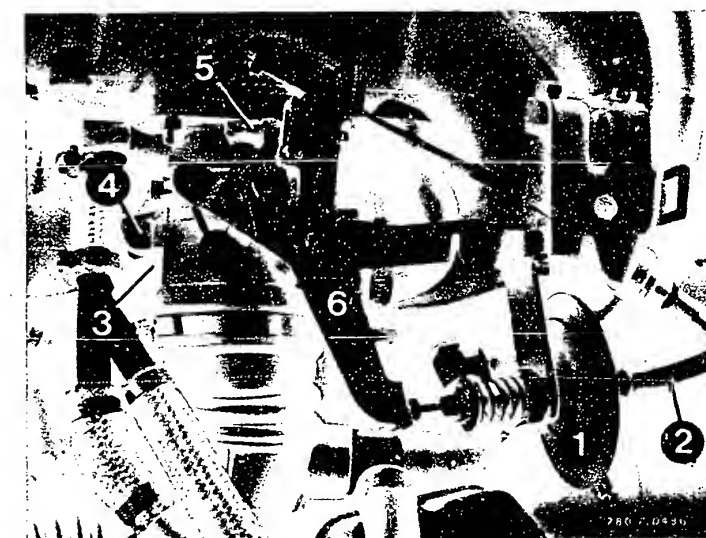
* Operation in vehicle:

fully depress accel.pedal

* Test specification (reading):0...10 Ω Is value measured within
test-specification tolerance?* Trouble-shooting:For testing, disconnect control-
unit plug from test adapter, and
use circuit diagram when necessary.Test following leads for continuity
using ohmmeter (nominal value
approx. 0 Ω):* From control-unit plug term. 3 to
throttle-valve switch term. 3Eliminate contact resistances at plug
connections.

280/0314

Top view of control-unit plug

3 = Throttle-valve switch
4 = Fastening screws

Continued on next coordinate

Component/Operation:

Pressure switch (part-load enrichment) where present.

At control-unit plug between terms. 3 and 9.

N>

Operation:Position

Program switch "V"	=>
Program switch "Ω"	17
Test button	

* Measuring equipment

Motortester or Multimeter (Ω range)

* Measuring range:

100 k Ω

* Connection:

Blue test jacks

* Operation in vehicle:

Operate Mityvac pump

* Test specification (reading):

Measuring equipment should show 28...32k Ω

Up to approx. 200 ... 260 mbar negative gauge pressure.

Is measured value within test-specification tolerance?

Y

Continued on next coordinate

* Trouble-shooting

For testing, disconnect control-unit plug from test adapter, and use circuit diagram when necessary. Connect Mityvac pump to the pressure switch. Operate Mityvac pump. Up to approx. 200...260 mbar negative gauge pressure: Reading 28...32 k Ω . Continue pump operation. Pressure switch should switch. Reading: Infinite Ω . Slowly bleed Mityvac pump. Starting at 170 mbar vacuum: Reading 28...32 k Ω .

Test connection cables between pressure switch and control-unit plug for continuity (nominal value approx. 0 Ω). If necessary replace cables for pressure switch. Test following leads for continuity using ohmmeter

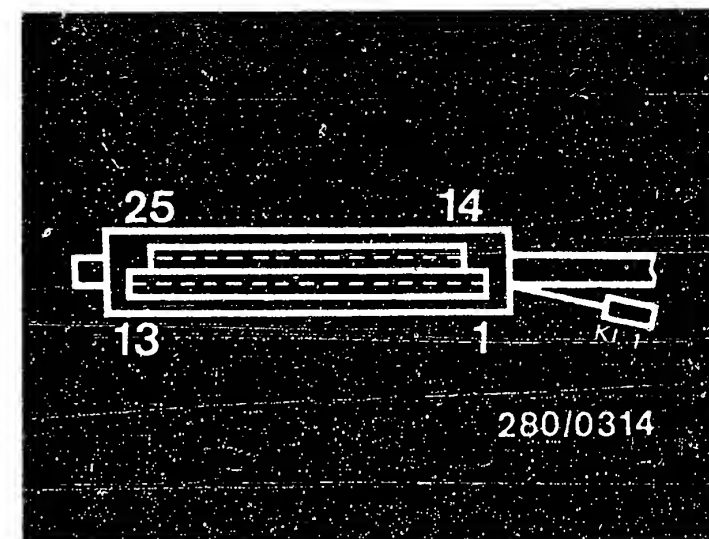
Nominal value approx. 0 Ω :

* From control-unit plug term. 3 to pressure switch term. 1 (lead 3).

* From pressure switch term. 3 (lead 9) to 70° thermo-switch, through switching contact (engine temperature > 70°) to control-unit plug term. 9.

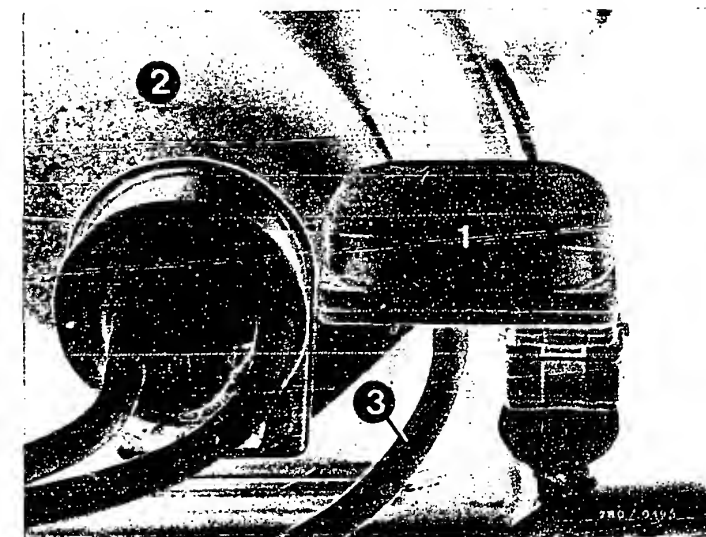
Eliminate contact resistances in plug connections.

Further testing: Is vacuum hose between pressure switch and intake manifold correctly connected? Is hose in good shape, not porous? If necessary, repair.



Top view of control-unit plug

- 1 = Pressure switch
- 2 = Air-filter cover
- 3 = Vacuum hose



Component/function:

Solenoid-operated valve
4/5 and 6 (connected in
parallel). Resistance value
at control-unit plug between
term.12 and term.9.

N>

* Operation:

	Position
Prog.-selec. switch "V"	⇒
Prog.-selec. switch "Ω"	18
Test button	

Prog.-selec. switch "V"	⇒
Prog.-selec. switch "Ω"	18
Test button	

Test button

* Measuring equipment:

Motortester or
multimeter

Measuring range:

x 1 Ω

Connection:

Blue measuring sockets

* Operation in vehicle:
not applicable

* Test specifications (reading):Solenoid-operated injec. valves

0 280 150 208/210

at (+15°C...+30°C):

8.20...10.90 Ω

at + 80° C:

8.70...11.70 Ω

Solenoid-operated injec. valves

0 280 150 716

at (+15°C...+30° C):

8.00...10.70 Ω

at + 80° C:

8.5 ... 11.5 Ω .

Is value measured within
test-specifications tolerance?

* Trouble-shooting:

For testing, disconnect control-
unit plug from test adapter, and
use circuit diagram when necessary.

Test following leads for continuity
using ohmmeter (nominal value approx.
0 Ω):

* From control-unit plug term. 12
to the solenoid-operated injection
valves.

* From injection valves to control
relay term. 87.

* From injection valves to control-
unit plug term. 9.

Resistance measurement at solenoid-
operated injection valve
(0 280 150 208/210):

Ambient temperature

(+15°C ... +30°C):

15...17,5 Ω

Engine at operating temperature
(approx. +80°C):

17...20 Ω

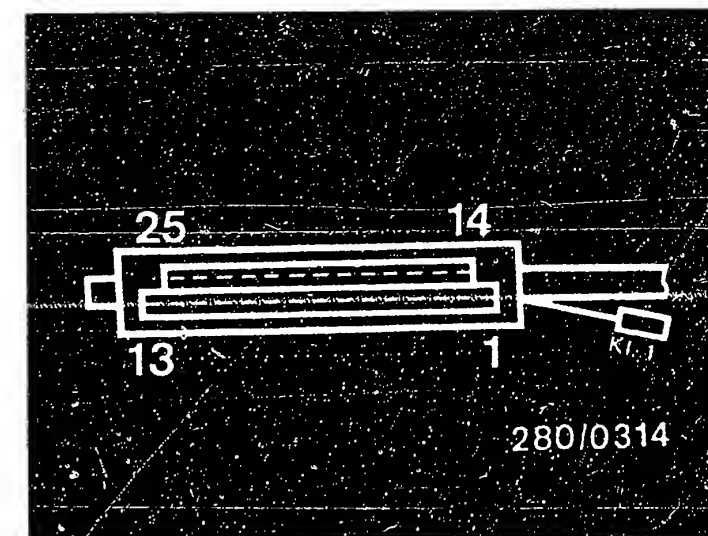
Upper illustration: Top view of
control-unit plug

Middle illustration: (Until 8.84)
Control relay disconnected, top view
of plug.

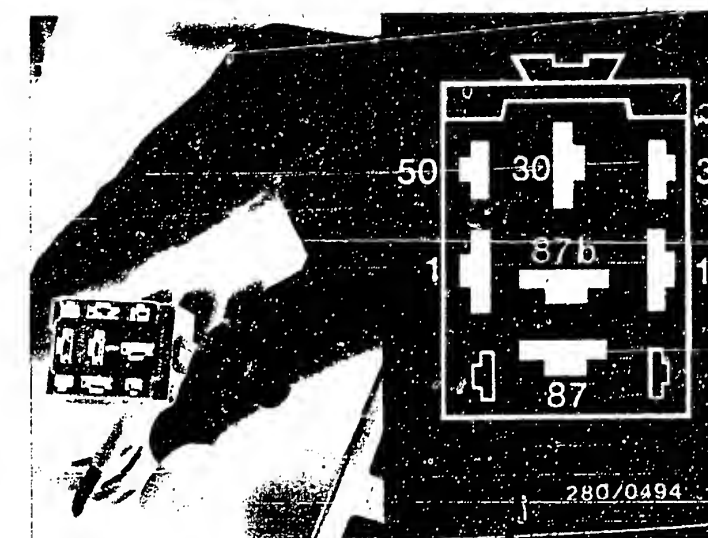
Lower illustration: (As of 9.84)

1 = Control relay

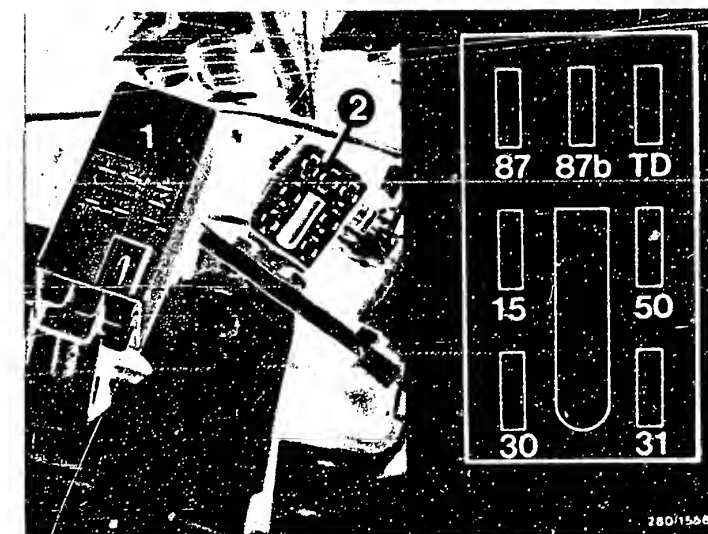
2 = Top view of connection base.



280/0314



280/0494



280/1508

Continued on next coordinate

Continued on next coordinate

V

Resistance measurement at solenoid-operated injection valve
(0 280 150 716):

Ambient temperature

(+15°C ... +30°C):

14,5...17,0 Ω

Engine at operating temperature

(approx. +80°C)

16,5...19,5 Ω

If reading too high: Break in valve coil or a valve plug has fallen out.
Check seating of plug contacts.

Upper illustration: Top view of control-unit plug

Middle illustration: (Until 8.84)

Control relay disconnected, top view of plug

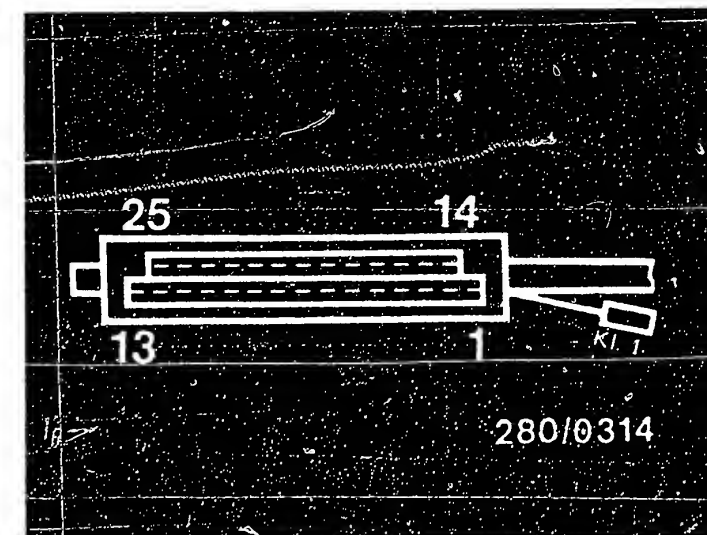
Lower illustration:

(As of 9.84)

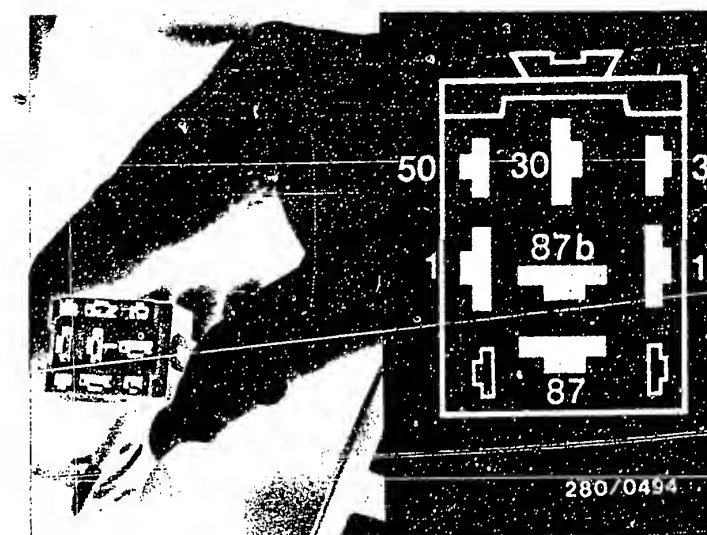
1 = Control relay

2 = Top view of connection base

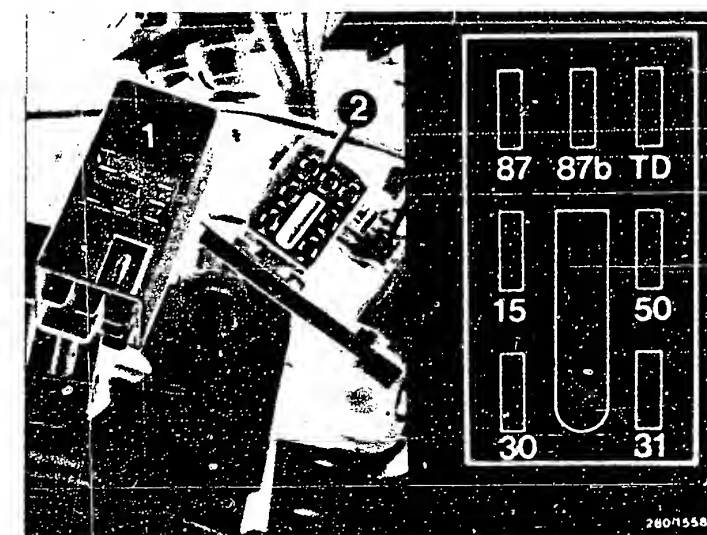
Installation position of components
Solenoid-operated injection valve:
Between intake manifold and valve hood.



280/0314



280/0494



280/1558

Continued on next coordinate

Component/function:

Solenoid-operated valve
1/2 and 3 (connected in
parallel). Resistance value
at control-unit plug between
term.24 and term.9.

N>

* Operation: Position

Prog.-selec. switch "V"	==>
Prog.-selec. switch "Ω"	19
Test button	

* Measuring equipment:

Motortester or
multimeter

Measuring range:

x 1 Ω

Connection:

Blue measuring sockets

* Operation in vehicle:
not applicable

* Test specifications (reading):

Solenoid-operated injec. valves

0 280 150 208/210

at (+15°C...+30°C):

8.20...10.90 Ω

at + 80° C:

8.70...11.70 Ω

Solenoid-operated injec. valves

0 280 150 716

at (+15°C...+30° C):

8.00...10.70 Ω

at + 80° C:

8.5 ... 11.5 Ω .

Is value measured within
test-specifications tolerance?

* Trouble-shooting:

For testing, disconnect control-
unit plug from test adapter, and
use circuit diagram when necessary.

Test following leads for continuity
using ohmmeter (nominal value approx.
0 Ω):

* From control-unit plug term. 24
to the solenoid-operated injection
valves.

* From injection valves to control
relay term. 87.

* From injection valves to control-
unit plug term. 9.

Resistance measurement at solenoid-
operated injection valve
(0 280 150 208/210):

Ambient temperature
(+15°C ... +30°C):

15...17,5 Ω

Engine at operating temperature
(approx. +80°C):

17...20 Ω

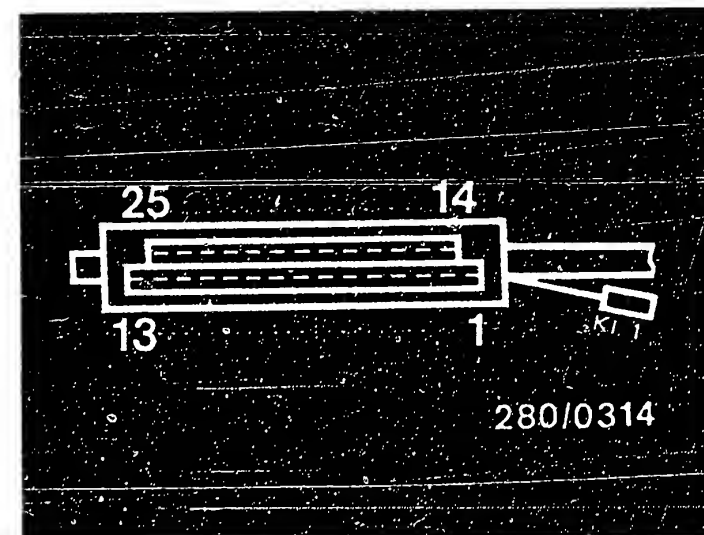
Upper illustration: Top view of
control-unit plug

Middle illustration: (Until 8.84)
Control relay disconnected, top view
of plug.

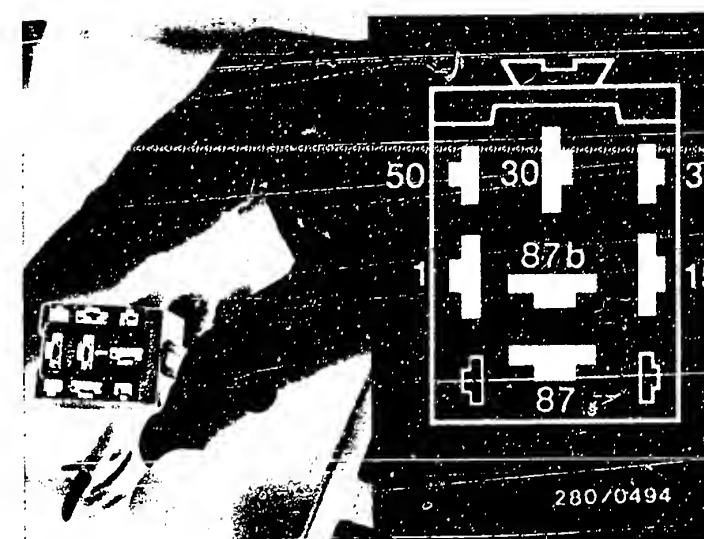
Lower illustration: (As of 9.84)

1 = Control relay

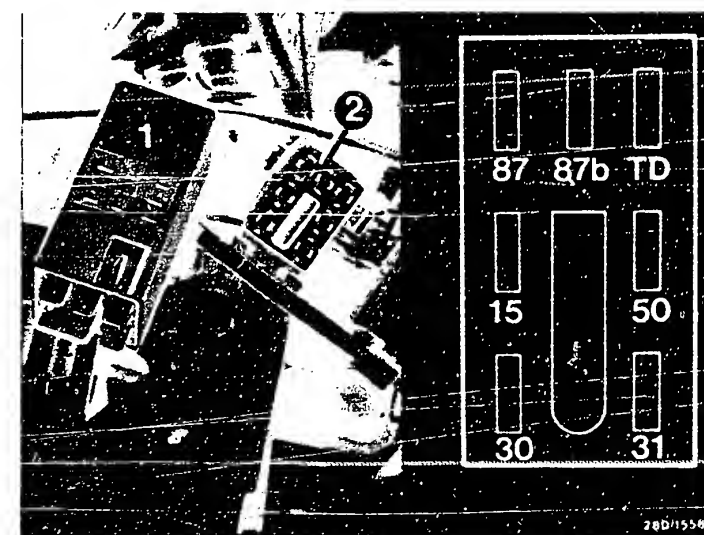
2 = Top view of connection base.



280/0314



280/0494



280/1556

Continued on next coordinate

Continued on next coordinate

V

Resistance measurement at solenoid-operated injection valve
(0 280 150 716):

Ambient temperature

(+15°C ... +30°C):

14,5...17,0 Ω

Engine at operating temperature

(approx. +80°C)

16,5...19,5 Ω

If reading too high: Break in valve coil or a valve plug has fallen out.
Check seating of plug contacts.

Upper illustration: Top view of control-unit plug

Middle illustration: (Until 8.84)

Control relay disconnected, top view of plug

Lower illustration:

(As of 9.84)

1 = Control relay

2 = Top view of connection base

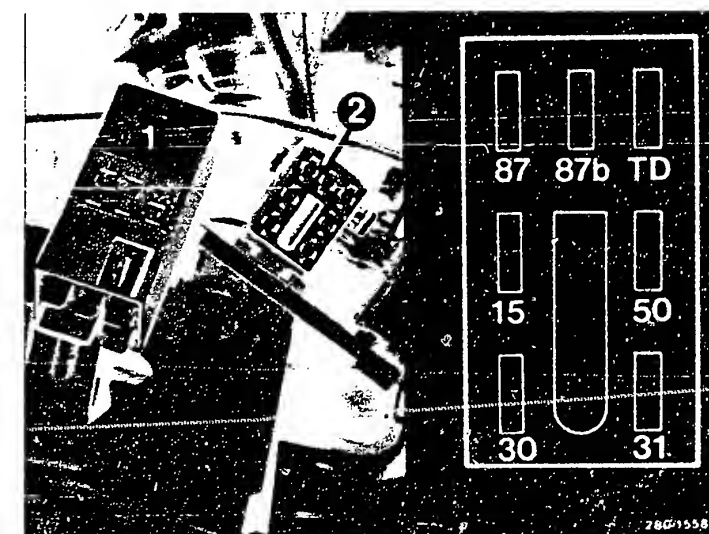
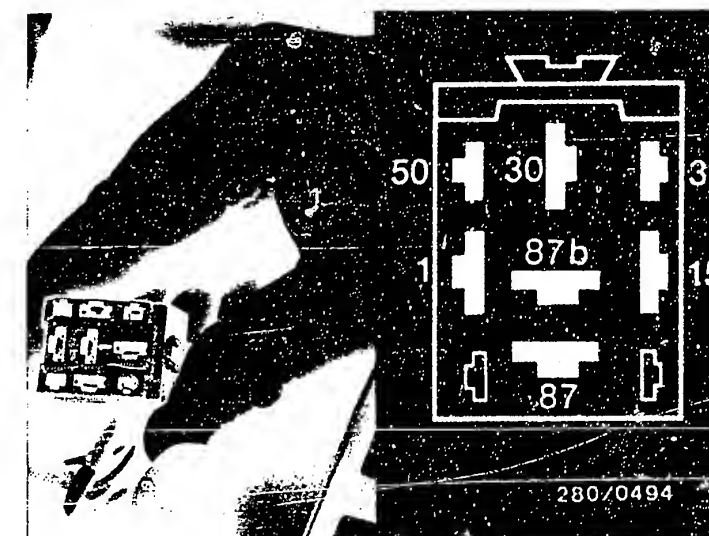
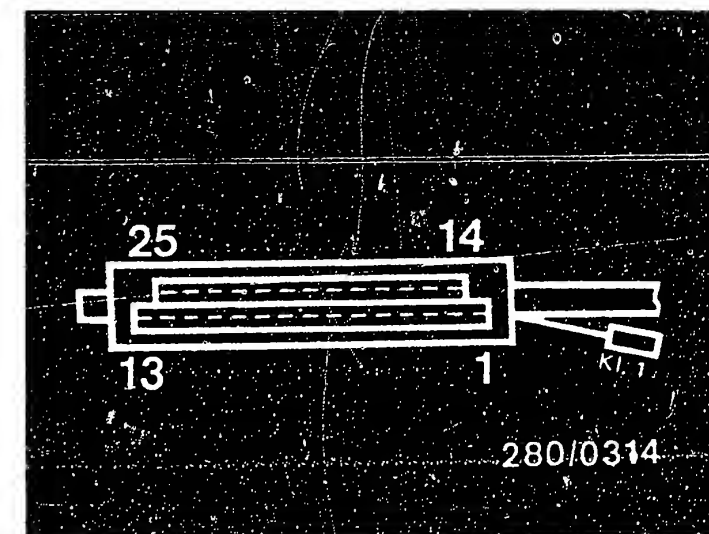
Installation position of components

Solenoid-operated injection valve:

Between intake manifold and valve hood.

Test with universal test adapter now completed.

Now perform the fuel pressure test.
On the following coordinates.



Fuel pressure test

Is electric fuel pump running?
(Listening test)

- * Is lead from ignition coil term. 1 or term. t_p to ignition trigger box term. t_p (term. 4) in order?
- * Is voltage present at term. 87b and electric fuel pump?
- * Is pump fuse O.K.?
- * Is ground lead O.K.?

N>

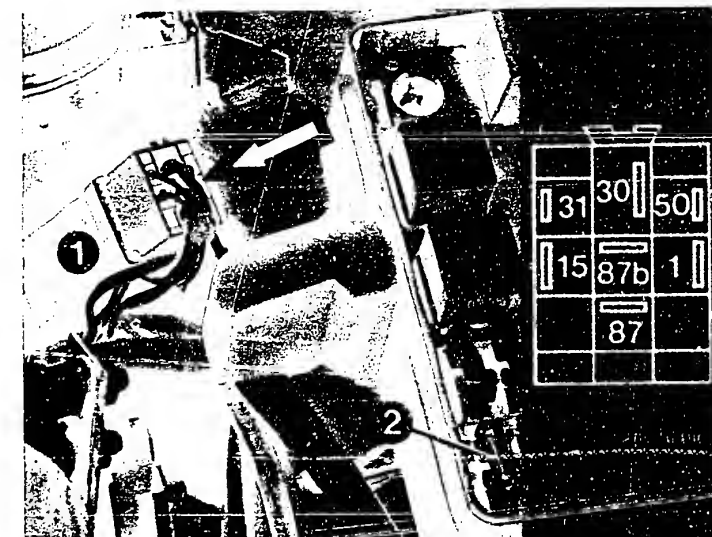
Test control relay

At inverted connection frame with control relay connect-

- * Test lead from term. 1 to ignition coil term. 1, and lead from term. 1 to ignition trigger box term. t_p (term. 4) for continuity (approx. 0 Ω). Start engine.
- * If no voltage at term. 87b, exchange control relay.

Test pump fuse:

Pump fuse (fuse box No. 1 in 5 Series model, No. 11 in 3 Series model) O.K.? If not → exchange. Check connecting cable.

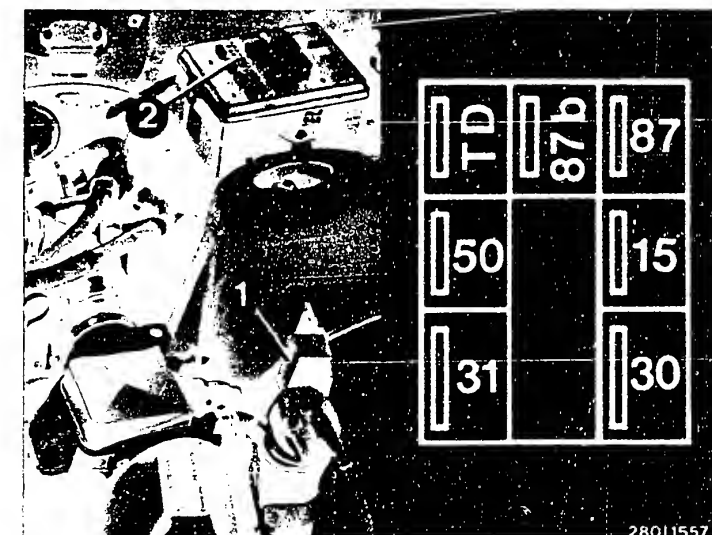


5201:

- 1 = Control relay, as of 9.84 control relay as 3201 / 3231
- 2 = Pump fuse (No. 1)
- Arrow = Measure voltage at rear of connection base.

3201 / 3231:

- 1 = Control relay
- 2 = Pump fuse (no. 11)



28011557

Continued on next picture page

Continued on next picture page

D17

⇒

D18

⇐

* Checking voltage supply to electric fuel pump.

- Voltage at connection terminals of electric fuel pump:
At least 12 V
- If not -> check ground lead.

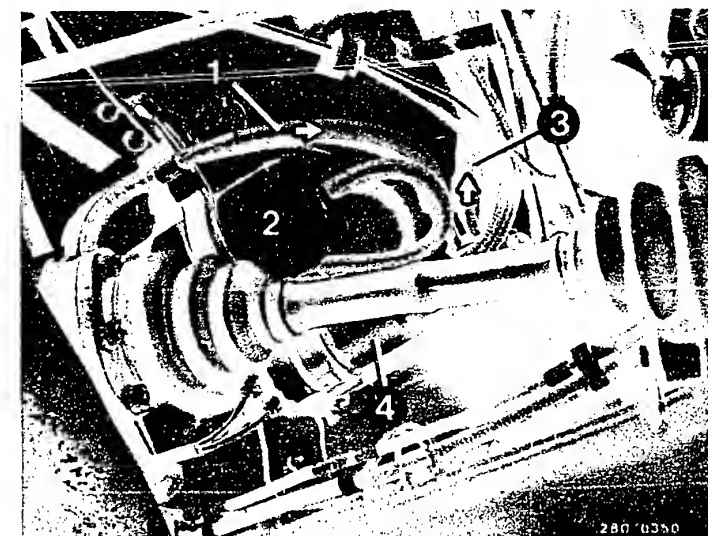
3 series:

Ground connection under rear seat on left.

5 series:

Ground connection on rear-axle support on left, near cable lead-through grommet for electric fuel pump.

If voltage present, replace electric fuel pump.

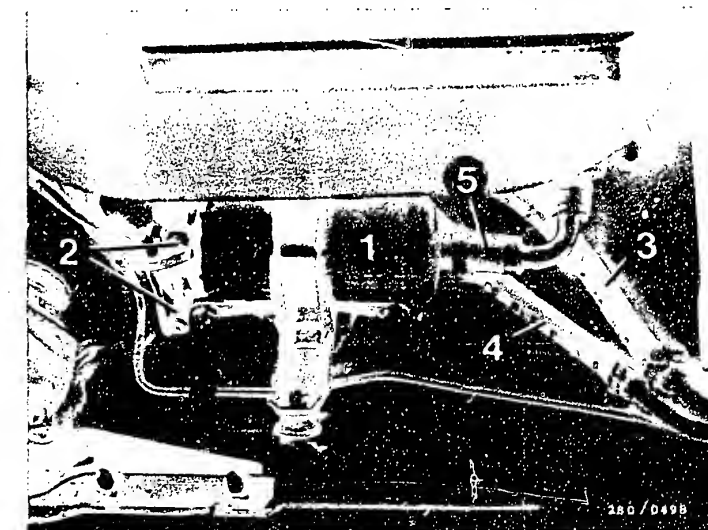


5201:

- 1 = Fuel delivery line
- 2 = Filter
- 3 = Fuel return line
- 4 = Electric fuel pump

3201 / 3231

- 1 = Electric fuel pump
- 2 = Electrical connections
- 3 = Fuel delivery line
- 4 = Fuel return line
- 5 = Section line



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* Fuel pump noise

In the event of:

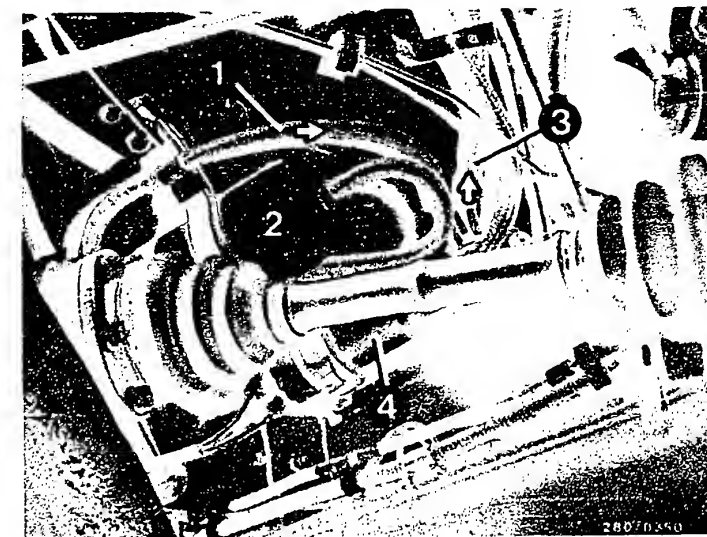
- A defective in-tank pre-supply pump
- High external/fuel temperatures
- A virtually empty fuel tank
- Lengthy driving at full load or idling
- The use of winter fuel during summer months

The electric fuel pump may be noisy during operation.

This is not a technical fault, but rather due to the principle involved, since vapor bubbles are produced when the boiling point is reached. The electric fuel pump is no longer provided with sufficient fuel and this causes noise.

Remedy/noise reduction:

- Renew in-tank pre-supply pump.
- Check pump suspension.
- Provide noise insulation for intake line
- Stick sound-deadening layer to bodywork (near pump).
- Eliminate kinks in intake line.
- Fill up fuel tank.

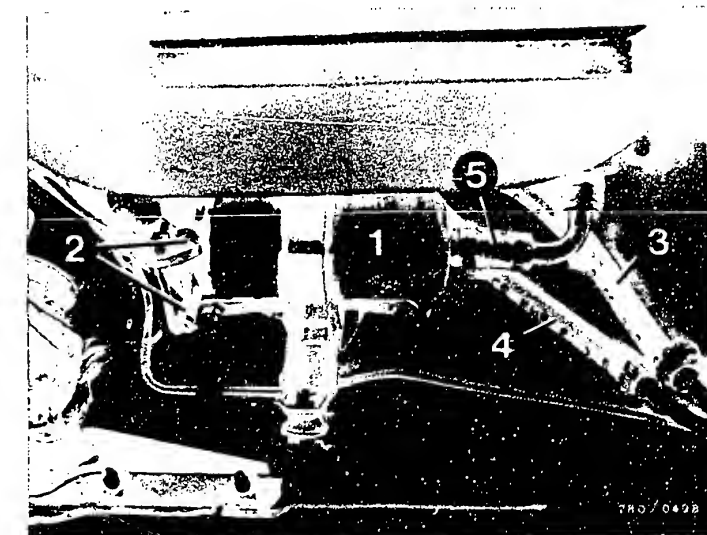


5201:

- 1 = Fuel delivery line
- 2 = Filter
- 3 = Fuel return line
- 4 = Electric fuel pump

3201 / 3231

- 1 = Electric fuel pump
- 2 = Electrical connections
- 3 = Fuel delivery line
- 4 = Fuel return line
- 5 = Section line



Continued on next picture page

Checking the fuel pressure (continued 3)

Fuel pressure O.K.?
Pressure regulator O.K.?

Test specification: 2,3...2,7 bar

Test specification obtained?

Checking the fuel pressure

* Connect pressure gauge or pressure tester to inlet of fuel-distribution pipe.

Use three-way line KDJE-P-100/13.

CAUTION !

When disconnecting the fuel hose, make sure that no fuel gets onto hot parts of the engine.

Connect the connections of the pressure tester into the fuel-injection tubing. If using the pressure tester KDJE-P 100, the valve screw must be turned shut; with KDEP 1034, only the right-hand screw.

The hose end is connected onto the fuel distributor, the free Y-piece connection onto the fuel-pressure hose.

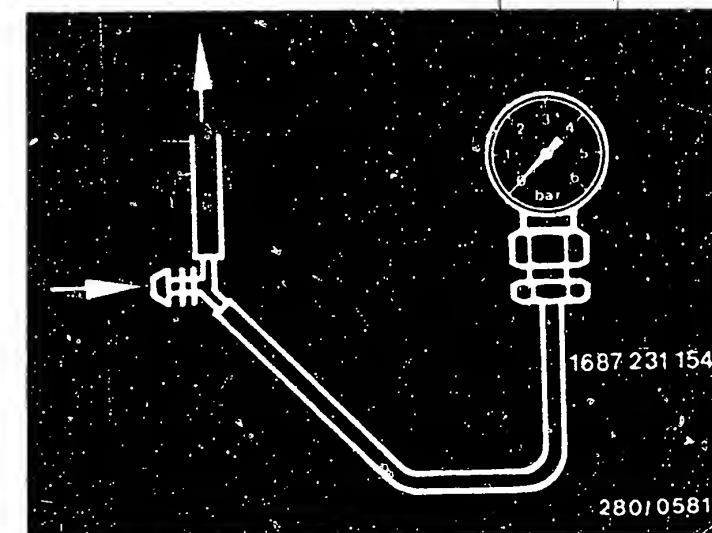
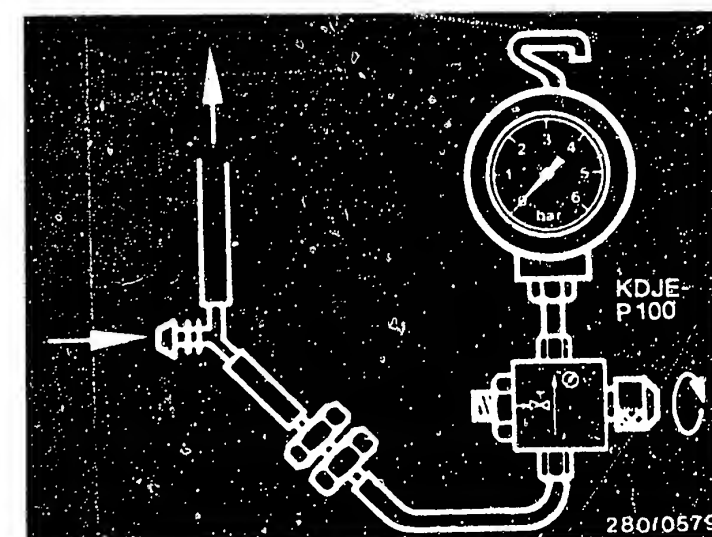
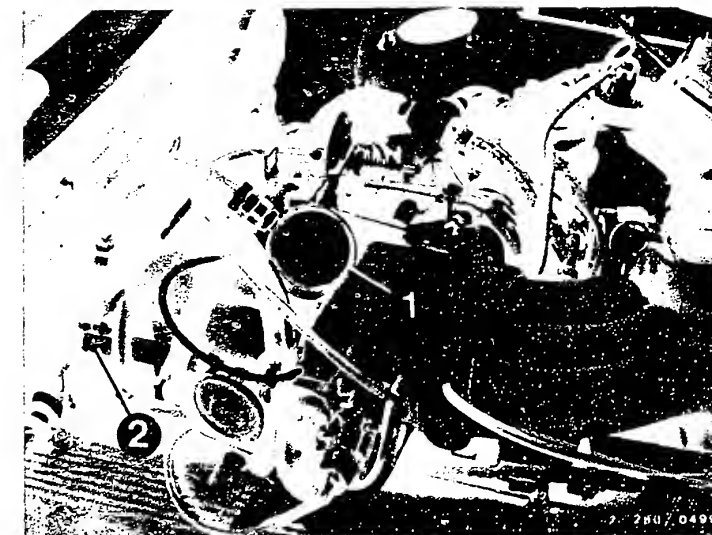
Make sure all joints are leak-tight.

Upper illustration:

520i, (320i / 323i similar)

1 = Pressure gauge

2 = Connection for pressure gauge to fuel distributor



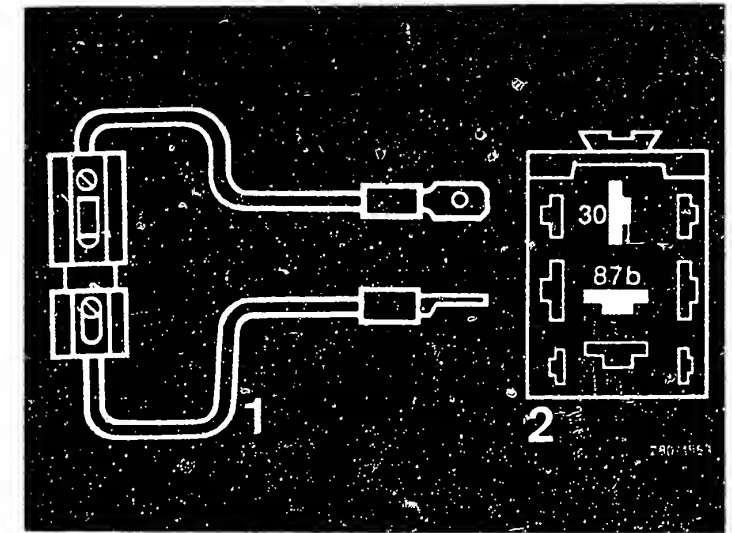
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Jumping the safety circuit.
Disconnect control relay. Connect jumper into connection base between term. 87b and term. 30. Electric fuel pump must operate.

Fuel pressure
Test specification: 2,3...2,7 bar

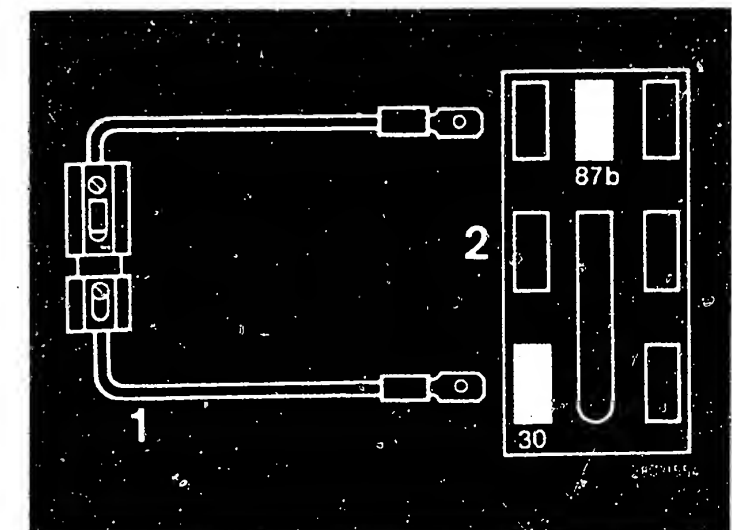
CAUTION !
Remove jumper and connect control relay. Let engine idle:
fuel pressure approx. 2.0 bar.



5201 until 8.84

1 = Jumper with fuse bracket and
10 A fuse (user-fabricated)
2 = Top view of connection base

As of 11.84



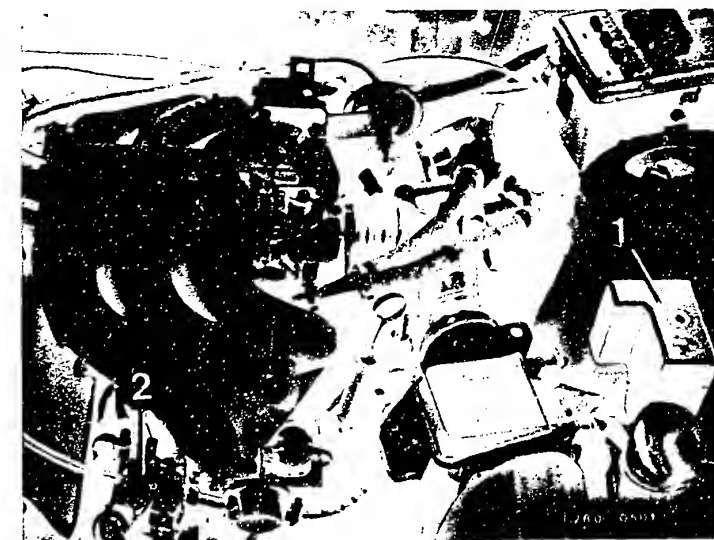
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* Disconnect control relay and connect jumper between terms. 87b and 30 in the connection base. Electric fuel pump must be running. Fuel pressure: 2,3...2,7 bar

Fuel pressure of 2,3 bar is not reached:

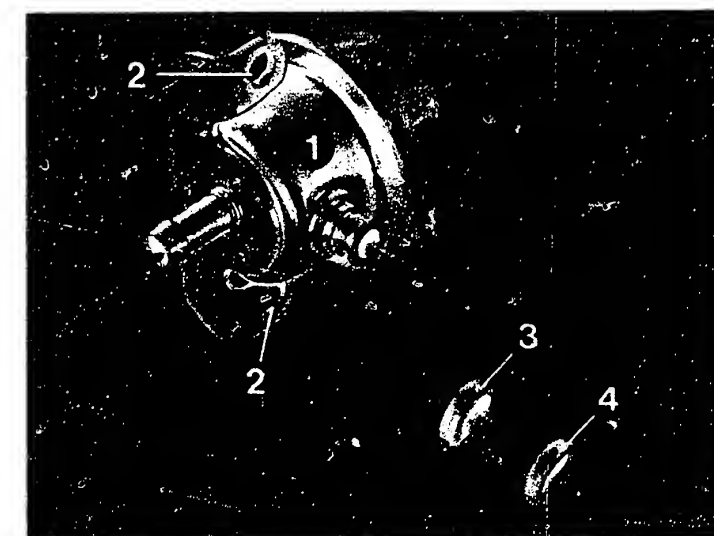
* S l o w l y pinch off fuel-return line (Careful: Do not subject pressure gauge to more than 6 bar!)

If the pressure rises above 4 bar -> replace pressure regulator. The fuel-pressure regulator is fastened with two fastening screws and an O-ring at the fuel-distribution pipe. After removing the pressure regulator, the O-ring and the flat ring must be replaced (use parts set 1 287 010 704).



1 = Control relay
(underneath cover)
2 = Pressure regulator

1 = Pressure regulator
2 = Mounting holes
3 = Flat ring
4 = O-ring



Continued on next picture page

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- * Check fuel delivery line and filter for flow-through.
- * Fuel-line pressure damper clogged
- * In-tank pre-supply pump (if provided) defective
- * Filter in tank clogged
- * Corrosion in tank

Fuel pressure of 2,7 bar is exceeded.

- * Fuel return line clogged or pinched.
- * Fuel-line-pressure damper clogged.
- * Replace pressure regulator.

Careful!

Jumper must always be removed after completing testing and the control relay re-connected.

3201 / 3231 (upper illustration):

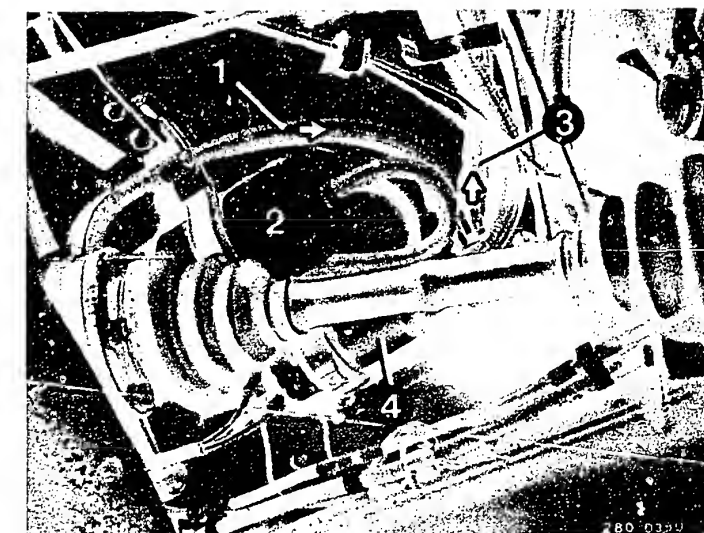
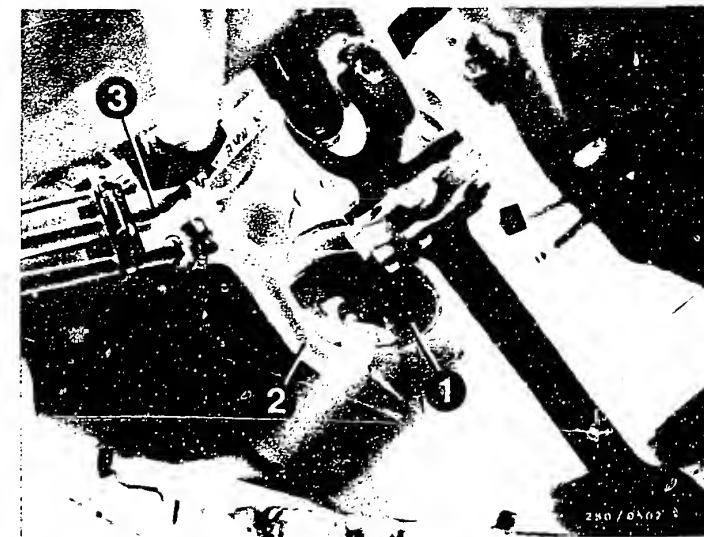
- 1 = Fuel filter
- 2 = Fuel delivery line
- 3 = Fuel return line

3201 / 3231 (middle illustration):

- 1 = Electric fuel pump
- 2 = Fuel-line-pressure damper
- 3 = Fuel spinner
- 4 = Fuel delivery line
- 5 = Fuel return line

5201 (lower illustration):

- 1 = Fuel delivery line
- 2 = Fuel filter
- 3 = Fuel return line
- 4 = Electric fuel pump



Continued on next picture page

Checking the fuel pressure (continued 7)

Does fuel pressure remain almost constant after engine has been switched off?

Test specification: 2,3...2,7 bar

Is test specification still obtained after 20 min.?

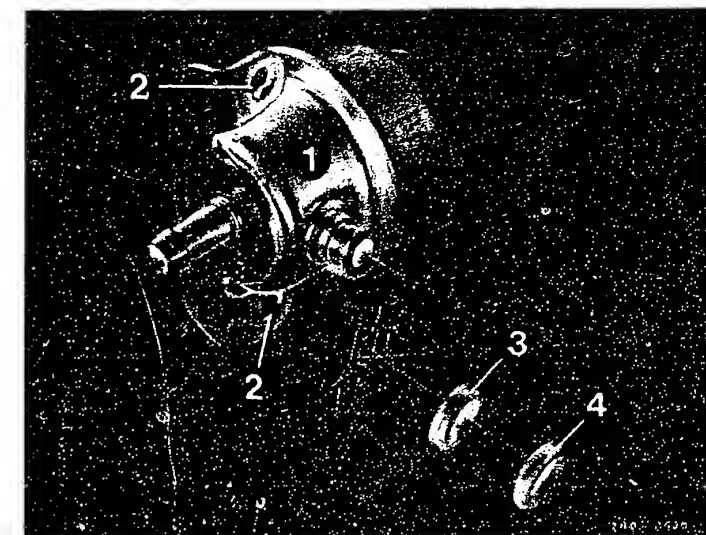
N>

The fuel pressure drops quickly after the hot engine has been switched off.

- * Check fuel system for leaks:
 - Jump the safety circuit
 - Fuel pressure 2,3...2,7 bar
 - Disconnect jumper and observe pressure gauge. After approx. 20 min. the fuel pressure must still be min. 1.0 bar.

If not:

- * Check joints between components, fuel hoses and fuel lines for leaks.
- * Pressure regulator (diaphragm)
- * Solenoid-operated injection valves (needle seat, valve not closing properly).
- * Electric fuel pump (non-return valve leaking)
- * Pressure damper or fuel filter leaking.



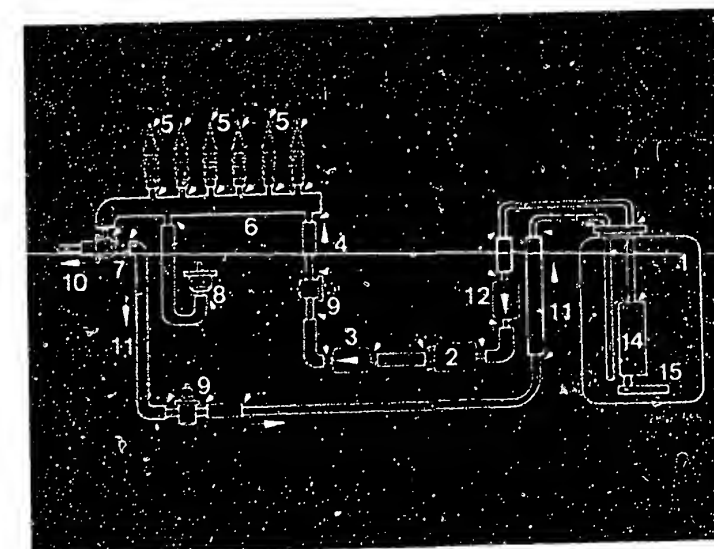
- 1 = Pressure regulator
- 2 = Mounting holes
- 3 = Flat ring
- 4 = O-ring

Remove pressure gauge. Re-establish connection between fuel delivery line and fuel-distribution pipe. Remove jumper and connect control relay in connection base. The fuel pressure test is completed.

If the fault has not been found or if further instructions are required on how to remedy the fault, continue with the trouble-shooting chart of your choice.

The detailed trouble-shooting chart is on Coordinates C03/C04 and the direct trouble-shooting chart on Coordinates C05...C08.

Fuel-line diagram:
Arrows indicate connection points between hoses and components.



STARTING MOTOR OPERATES, ENGINE FAILS TO START OR STARTS ONLY WITH GREAT DIFFICULTY

Trouble-shooting program according to customer complaints

Procedure

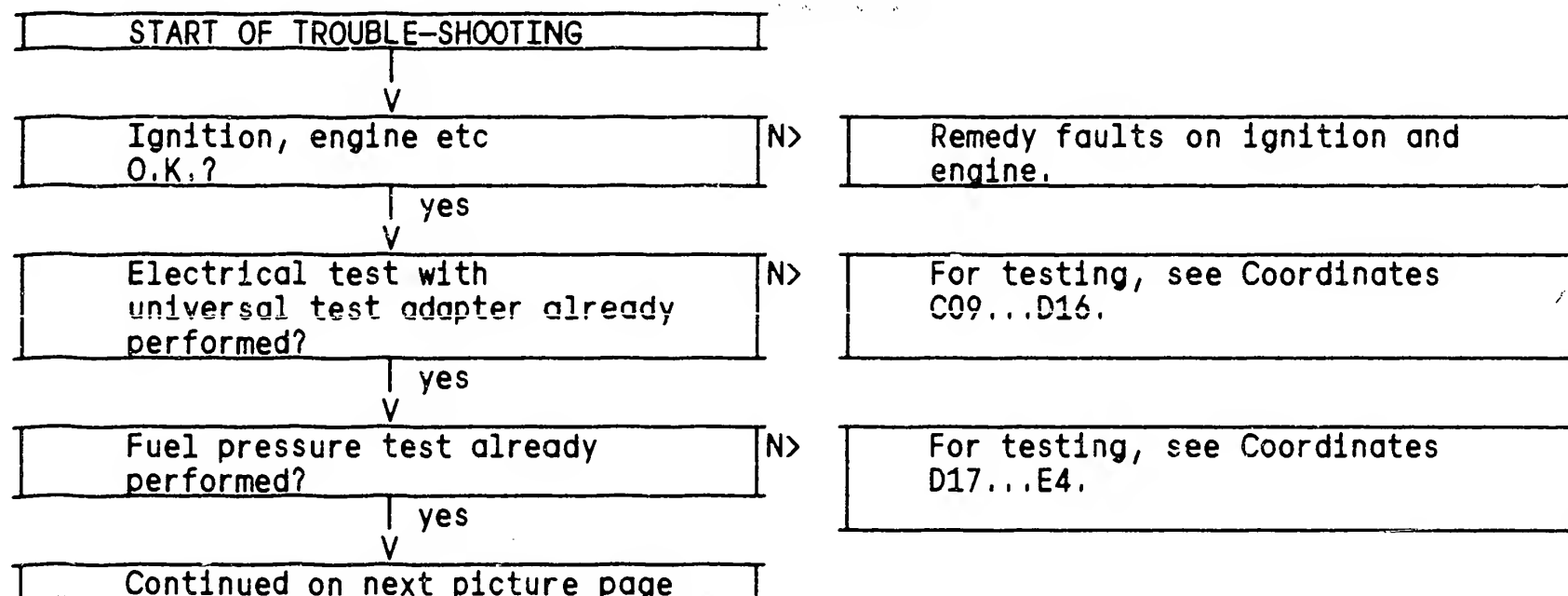
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Starting motor operates, engine fails to start (continued 1)

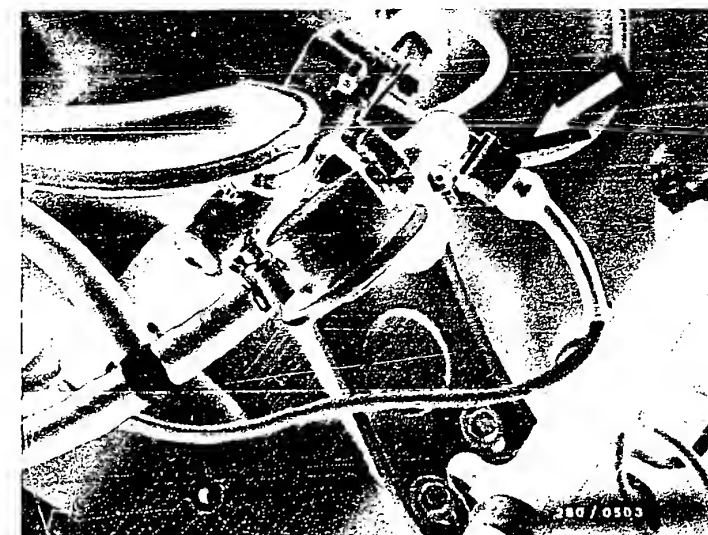
Check start valve.
(Not applicable as of 9.84)
* In good electrical order?
* No leakage at start valve?

N>

Function test:
Test voltage supply during starting.
To do this, pull plug from start
valve and connect voltmeter at term.
30 and terms. 29/24 of the plug.
1. Coolant at ambient temperature
(+15°C ... +30°C):
Voltage reading at least 6 V.
2. Coolant temperature with engine
at operating temperature
(approx. 83°C):
Voltage reading approx. 0 V.

Test following leads for contin-
uity using ohmmeter (nominal value
approx. 0 Ω):
* Lead from term. 30 on start valve
to thermo-time switch term. "W".
* Lead from term. 29 on start valve
to thermo-time switch term. "G".
* Lead from control unit term. 4 to
control relay term. 50. Check
ground connection of thermo-
switch.

Electrical test:
Connect ohmmeter to start valve
terms. 29 and 30.
Nominal value: Approx. 4 Ω



Arrow = Solenoid-operated
cold-start valve (blue plug)

Arrow = Thermo-time switch
(brown plug)



Continued on next picture page

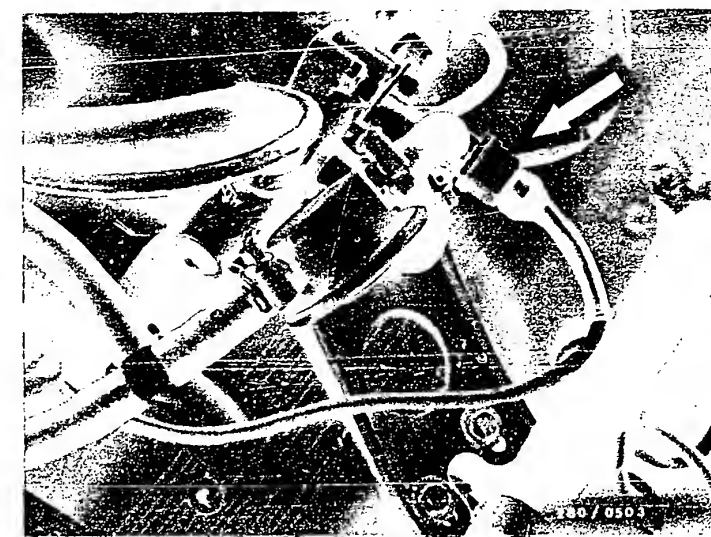
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Starting motor operates, engine fails to start (continued 2)

Mechanical test:

Remove start valve and place in a container (fire hazard!). During starting and at ambient temperature (+15°C ... +30°C) the start valve should spray (max. 8 sec.).

With the engine at operating temperature (+80°C), ignition switched on, and pressure built up, the start valve should not spray. Carry out a spray check with the engine at operating temperature (+80°C) as follows: Disconnect plug on thermo-time switch and connect term. "W" to ground. Start engine.



Arrow = Solenoid-operated cold-start valve (blue plug)

Continued on next picture page

Continued on next picture page

Starting motor operates, engine fails to start (continued 3)

V

Leakage test:

1. When installed:

Pinch off fuel delivery line at start valve. If engine then runs evenly, replace start valve.

2. When removed:

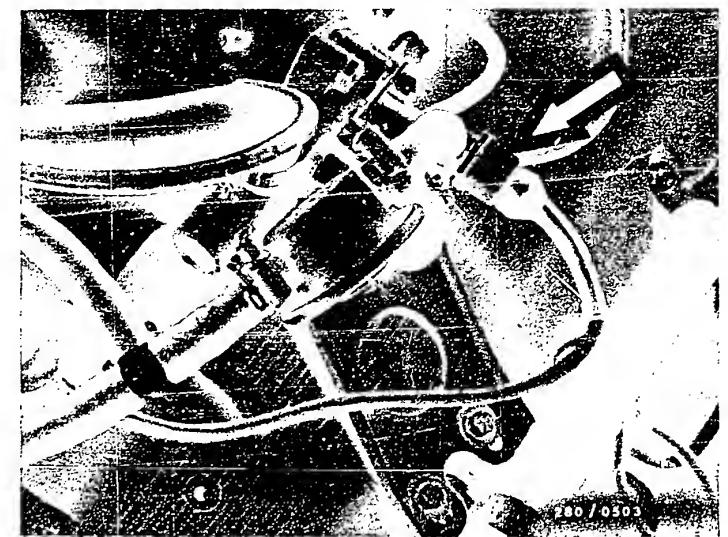
Remove start valve (fire hazard!). Fuel line and electric leads remain connected (place a catching basin underneath the start valve!). Build up fuel pressure (disconnect control relay, connect jumper between terms. 87 V and 30 in the connection base).

TEST SPECIFICATION:

Within one minute no more than one drop may form at the valve mouth.

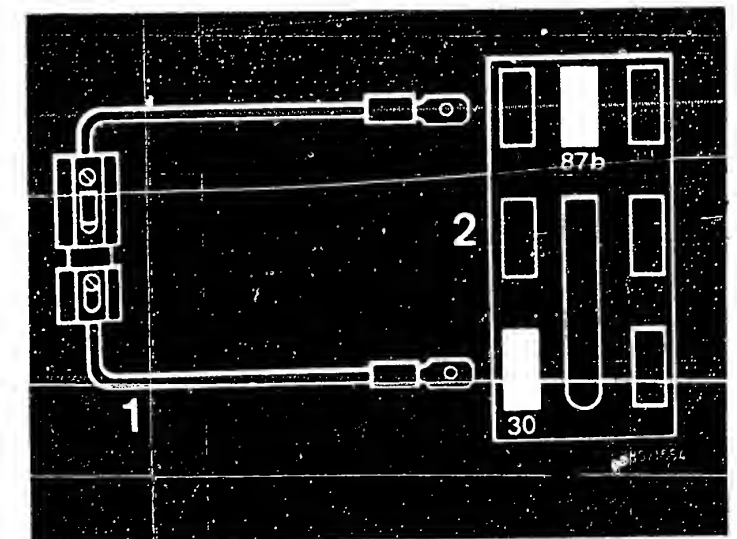
CAREFUL!

Jumper must always be removed after completing testing, and the control relay re-connected.



Arrow = Solenoid-operated cold-start valve (blue plug)

- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
- 2 = Top view of connection base (3/5 series until 8.84 similar)



Continued on next picture page

Starting motor operates, engine fails to start (continued 4)

Thermo-time switch O.K.?

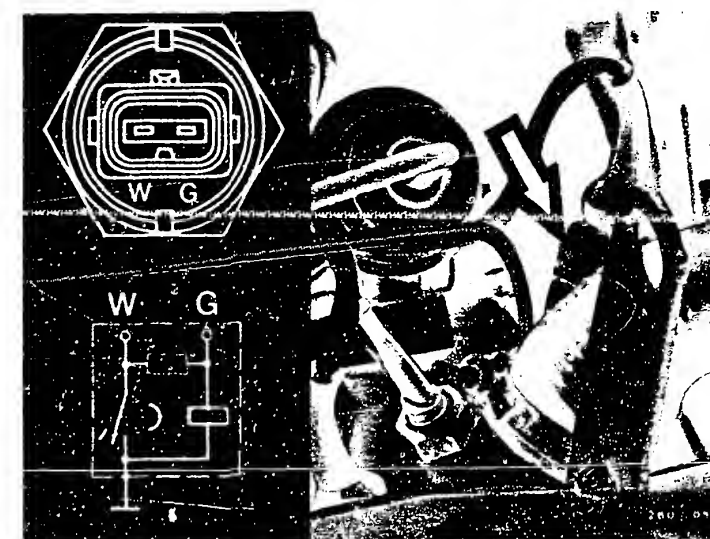
(Not applicable as of 9.84)

N>

Electrical testing:

Thermo-time switch 35°C/8 sec., test as follows: Pull plug and measure directly at thermo-time switch with ohmmeter.

1. Between term. "G" and ground at ambient temperature (below +30°C): 25...40 Ω
Engine at operating temperature (above +40°C): 50...80 Ω
2. Between term. "W" and ground at ambient temperature (below +30°C): 0 Ω
Engine at operating temperature (above +40°C): 100...160 Ω
3. Between terms. "G" and "W" at ambient temperature (below +30°C): 25...40 Ω
Engine at operating temperature (above +40°C): 50...80 Ω



Arrow = Thermo-time switch
(brown plug)

Continued on next picture page

Starting motor operates, engine fails to start (continued 5)

Start control (control-unit function) in order? (As of 9.84)

- * Connect test lead between one solenoid-operated injection valve.
- * Pull blue plug from temperature sensor II (engine).
- * Connect motortester or multimeter to test lead (position V, measuring range 10 V).
- * Pull out pump fuse.
- 5 series no. 1.
- 3 series no. 11.
- * Disconnect ignition lead at ignition coil term. 4 and connect ignition coil term. 4 to ground via a series resistor and a spark gap or connect the ignition-coil-capacitor tester.

Start engine.

Engine must not start. Does voltage at solenoid-operated injection valve fall during starting from approx. 4 V to approx. 0,5 V?

(With engine at operating temperature or connected NTC II plug the initial voltage is below 0.5 V).

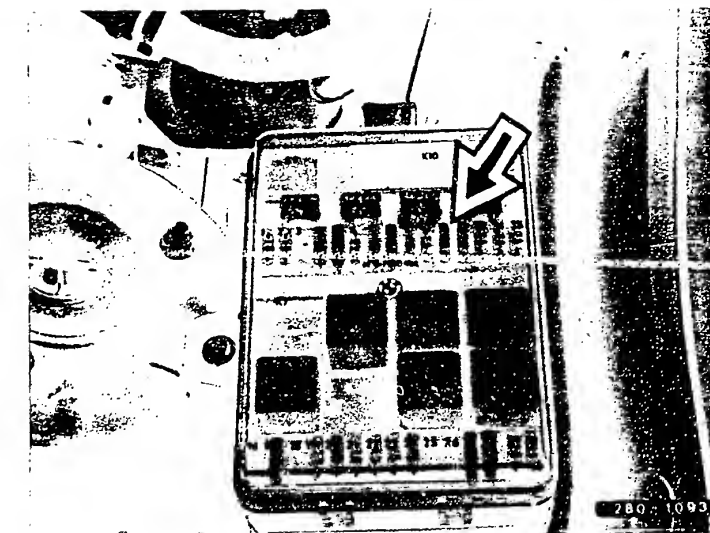
After testing restore to original installed condition.

Function test:

- * Remove pump fuse (in central fuse box).
- 5 series no. 1.
- 3 series no. 11.
- * Disconnect ignition lead at ignition coil term. 4 and connect ignition coil term. to ground via a series resistor and spark gap (ignition-coil-capacitor tester 0 681 100 001).
- (Careful! Engine must not start).

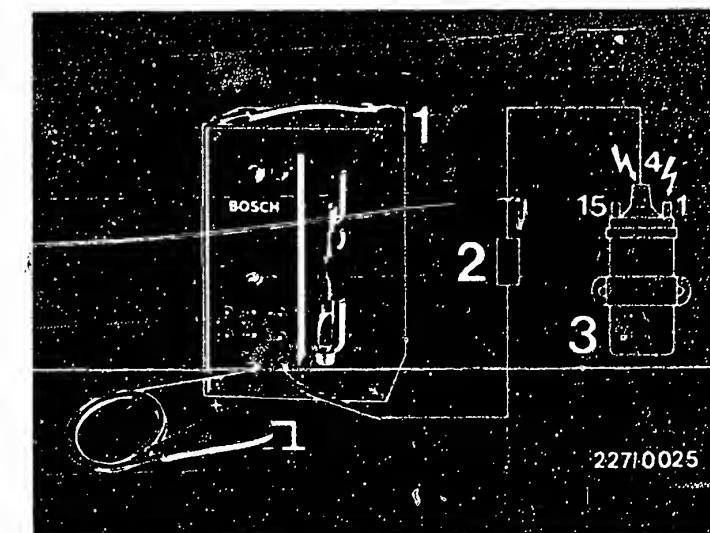
C a r e f u l !

When using a spark gap an interference-suppression resistor of at least $2\text{ k}\Omega$ e.g., sleeve-type suppressor (5 $\text{k}\Omega$) 0 356 500 001, must be connected between the spark gap and ignition coil term. 4, in order to prevent irreparable damage to the trigger box.



Arrow = Pump fuse
3 series no 11,
5 series no. 1

1 = Ignition-coil-capacitor tester or spark gap
2 = 5 $\text{k}\Omega$ sleeve-type suppressor
3 = Ignition coil
C a r e f u l !
Hazardous voltages
(400 V – 25 kV)
at terms. 1 and 4.



Continued on next picture page

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Starting motor operates, engine fails to start (continued 6)

V

- * Connect 2-pin adapter lead

between a solenoid-operated injection valve and its electrical connecting cable.

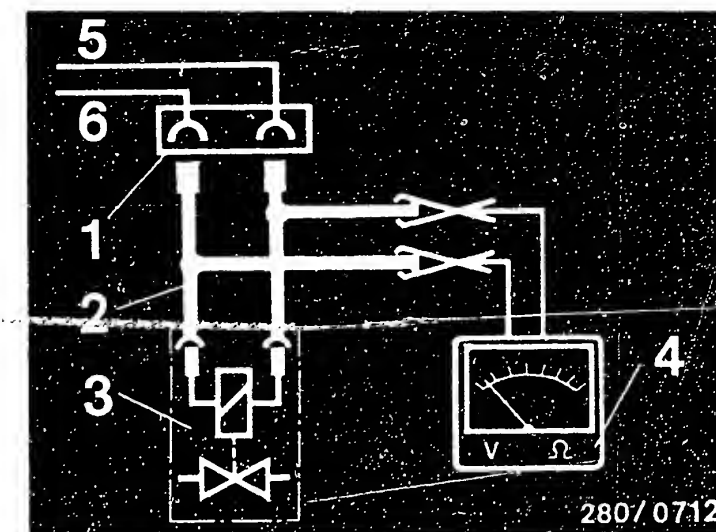
- * Connect multitester or motortester to free test pin.
Measurement range approx. 10 V.
- * Pull cable plug from temperature sensor II (engine) (blue plug)

Measurement

- * Start engine
- * Voltage reading falls from initial approx. 1 684 463 093 V within approx. 4 s of starting to approx. 15 V.
If these values are not reached → replace control unit.
- * Voltage testing cannot be repeated until after approx. 1 minute.
- * Connect cable plug to temperature sensor. Engine at operating temperature.
Start → voltage reading lower than 0.5 V.
If not → replace temperature sensor II.

Note!

After testing, restore to original installed condition.



- 1 = Plug connector of injection-valve cable
- 2 = Test lead 1 684 463 093
- 3 = Solenoid-operated injection valve
- 4 = Multimeter or motortester
- 5 = From control relay term. 87
- 6 = From control relay term. 12/24

Arrow = Temperature sensor II
(engine) on engine block
(blue plug)



Continued on next picture page

Starting motor operates, engine fails to start (continued 7)

Auxiliary-air device mechanically
O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose
pinched off

N>

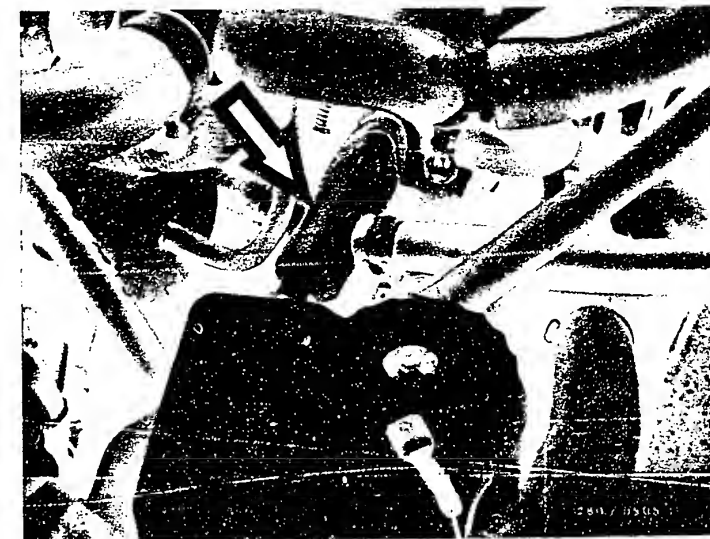
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down
(possibly using a small mirror).
When cold, the cross section must be
partially open; when the engine is
warm, it must be closed. If not,
replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose
to auxiliary-air device. Engine
speed must drop. With engine warm,
pinch off hose to auxiliary-air
device. There must be no noticeable
drop in engine speed. If not,
replace auxiliary-air device (paying
attention to direction of flow).



Arrow = Auxiliary-air device

Continued on next picture page

Starting motor operates, engine fails to start (continued 8)

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

N>

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

Testing:

Loosen clamp fasteners on air filter, lift off air filter upper section.

- * Test sensor flap for freedom of motion:

Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.

- * Mechanical test of air-flow sensor:

Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

Upper illustration: 3201/ 3231:

1 = Air-flow sensor

2 = CO adjusting screw

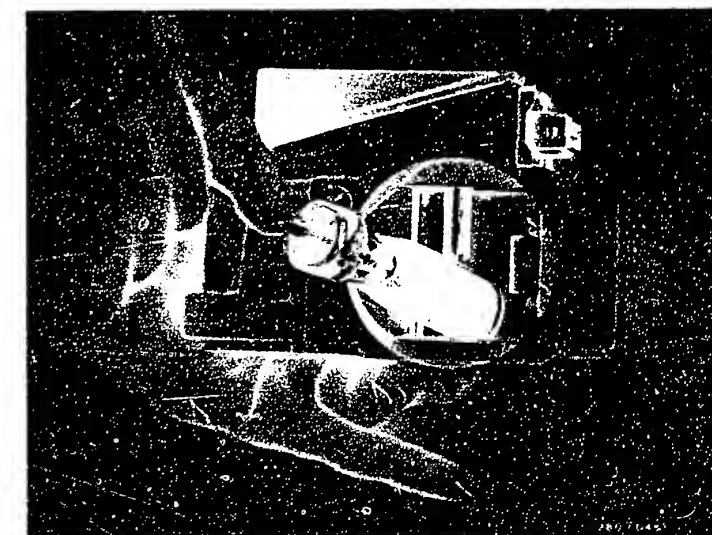
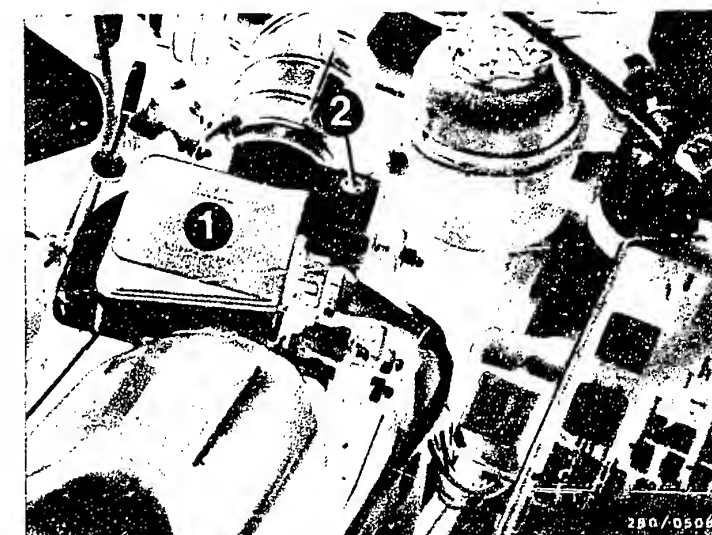
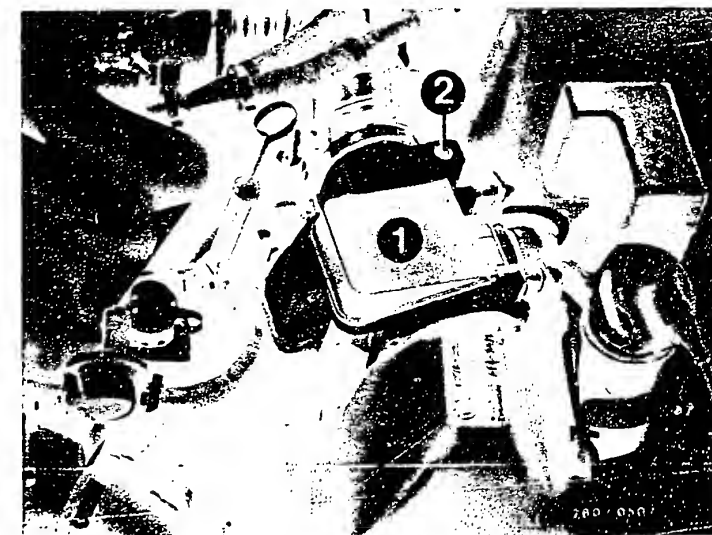
Middle illustration: 5201:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



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Starting motor operates, engine fails to start (continued 9)

* Check resistances:

Connect ohmmeter to terms. 8 and 9 of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and 5 of the air-flow sensor. Deflect sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air filter and air-flow sensor must be re-assembled.

Upper illustration: 320i / 323i:

1 = Air-flow sensor

2 = CO adjusting screw

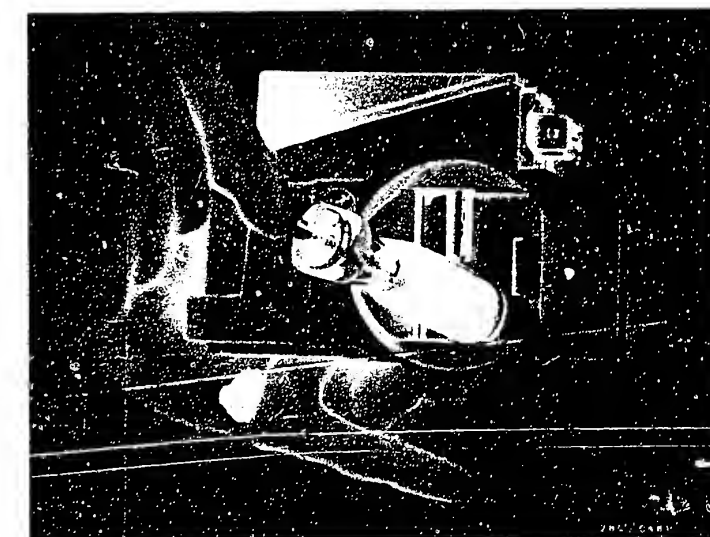
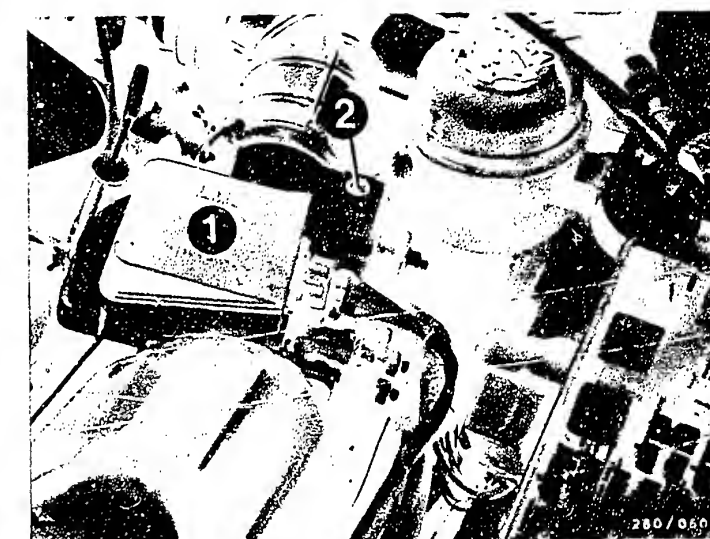
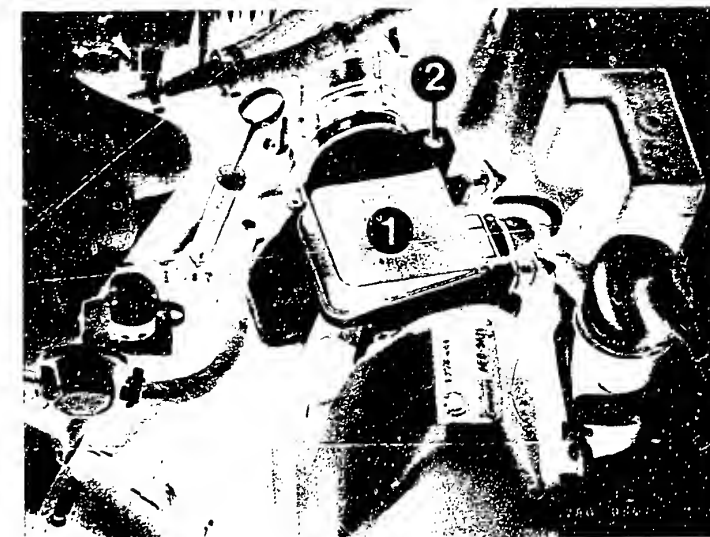
Middle illustration: 520i:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Starting motor operates, engine fails to start (continued 10)

V

No coughing during starting?

N>

V

Test CO setting:

1. Europe version:
With engine at operating temperature, less than 1.5 vol. % CO:
2. Sweden/Switzerland version:
0.3 ... 0.6 vol.% CO. (Hose connected to the air valves).

Setting in case of fault:

Idle speed:

750...850 min⁻¹

CO setting:

0.8 ... 1.2 vol.% CO
with air-valve hose disconnected and sealed.

C a r e f u l !

Start without moving accelerator pedal.

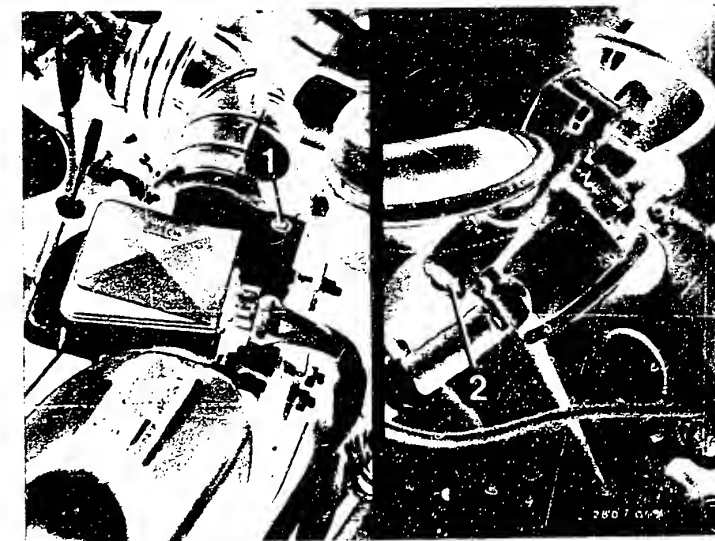
In idle and CO testing or adjustment, secondary-air induction must be rendered inoperative. To do this, disconnect the hose between the air valve and the air filter at the air filter (arrow) and seal tightly with a plug. Deactivation of secondary-air induction during operation of vehicles in countries without timed exhaust regulations is not required.

V

V

Continued on next picture page

Continued on next picture page



1 = CO-adjusting screw

2 = Idle-speed adjusting screw

All vehicles:

If the CO component is too low, turn the bypass screw (CO-adjusting screw) in the air-flow sensor one half turn clockwise (Allen-head screw, A/F 5).

Check idle speed and CO component again.

If necessary, carry out correction in several steps.

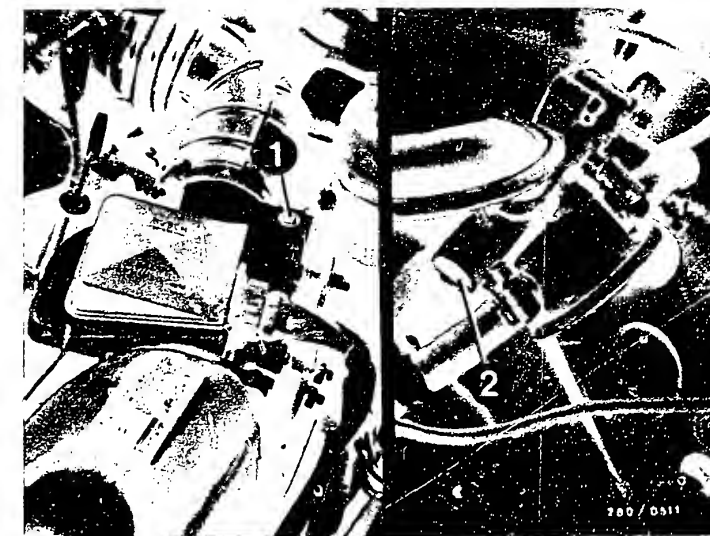
After adjustment use a new (red) plug (1 280 508 012)

Has defect been rectified?

If not, install a resistor ($R = 500 \dots 800 \Omega$) in lead no. 10 to NTC II

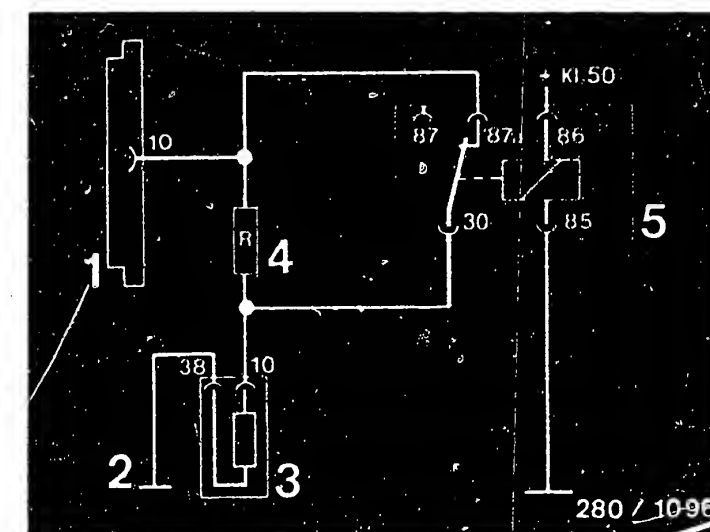
However, this resistor comes into operation only during starting (mixture enrichment).

See adjacent circuit diagram for wiring in vehicle.



- 1 = CO-adjusting screw
- 2 = Idle-speed adjusting screw

- 1 = Control-unit plug
- 2 = Electronics ground terminal as of 9.84
Output stage ground terminal until 8.84
- 3 = Temperature sensor II
- 4 = Resistor, $500 \dots 800 \Omega$, 0.3 W
- 5 = Relay (e.g. 0 332 204 150), leads 0.75 mm²



Starting motor operates, engine fails to start (continued 12)

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

Trouble-shooting program for customer complaint

starting motor operates, engine fails to start or starts only with difficulty

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04.

Direct trouble-shooting chart coordinates C05...C08.

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.

Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.

Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.

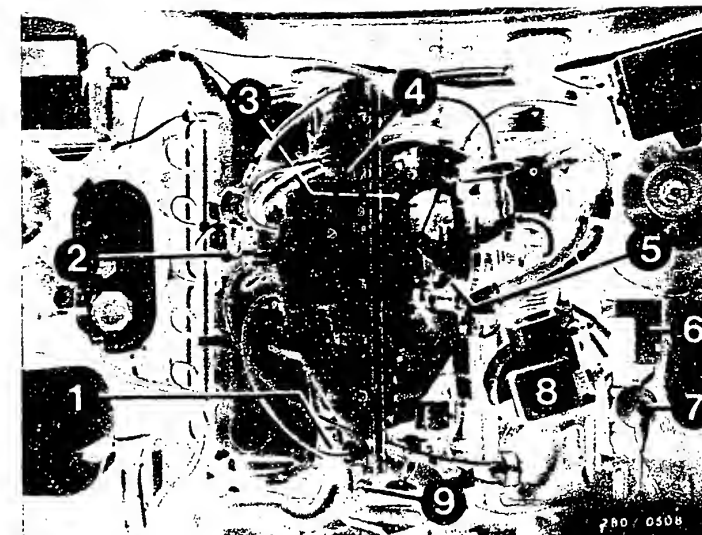
Seal off connection port on auxiliary-air device.

Open throttle valve fully while doing this.

Brush or spray all joints with soapy water.

Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.

Bubbling or foaming indicates a leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

ENGINE STARTS BUT THEN DIES

Trouble-shooting program according to customer complaints

Procedure

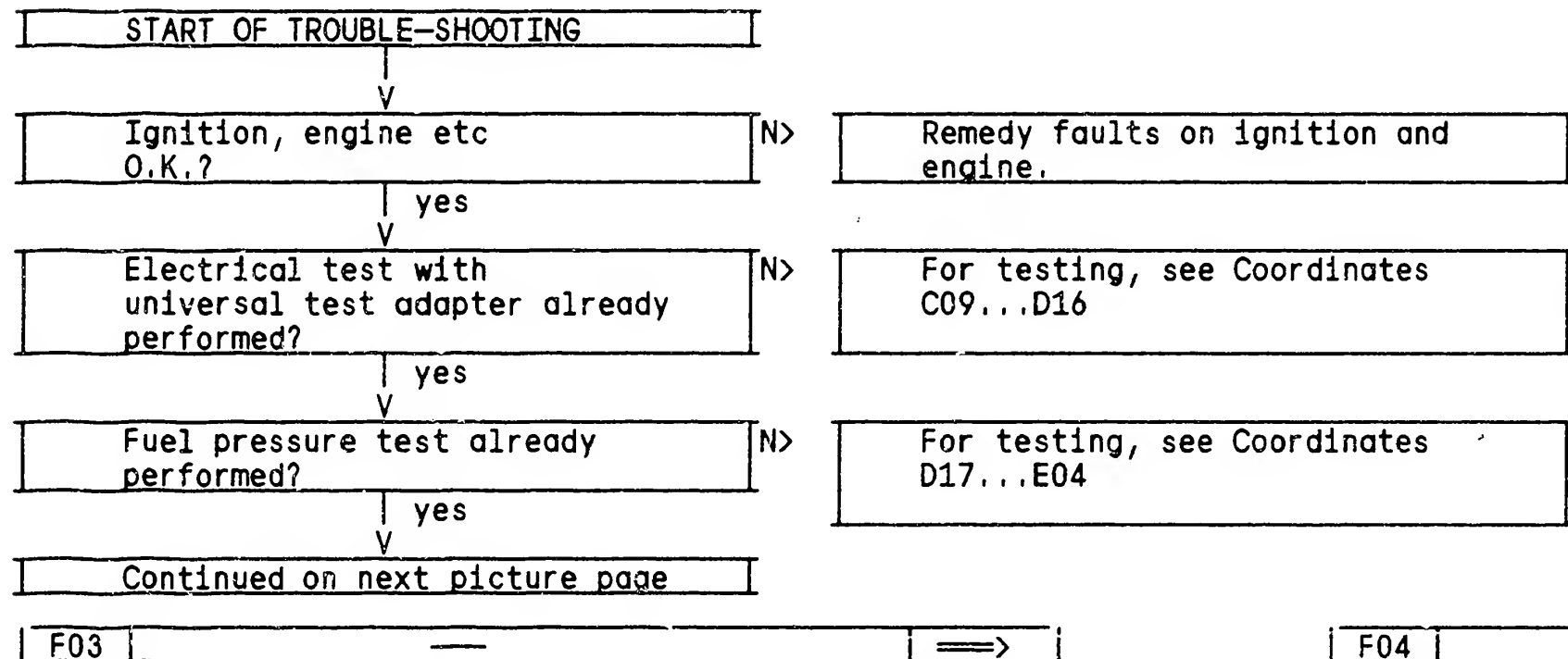
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Engine starts but then dies (continued 1)

Is start valve O.K.? (As of 9.84)
(Leak test)

N>

Testing solenoid-operated cold-start valve for sealing:

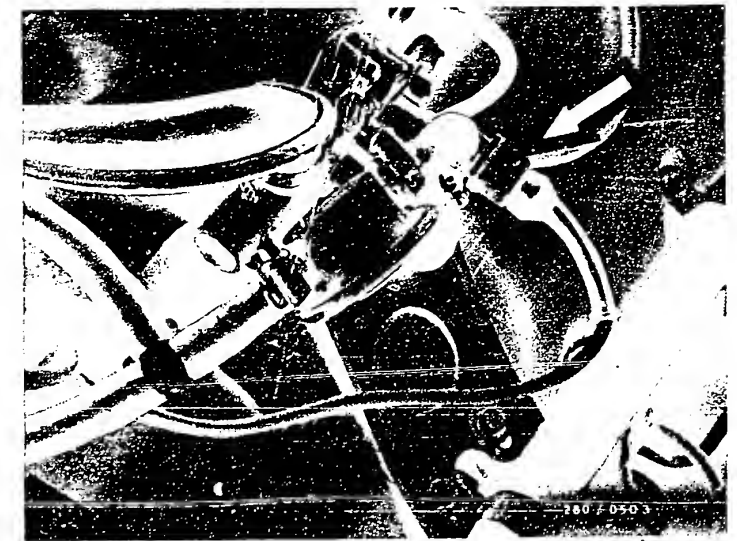
1. In installed condition:
Pinch off fuel delivery line at start valve. If engine then runs smoothly, replace the start valve.
2. When removed:
Remove solenoid-operated cold-start valve (careful: Fire hazard!). Fuel lines and electric leads remain connected (place catch basin underneath start valve). Generate fuel pressure (disconnect control relay, insert cable bridge between terms. 87b and 30 in connection base).

Test specification:

Within one minute a maximum of 1 drop may form at the valve opening.

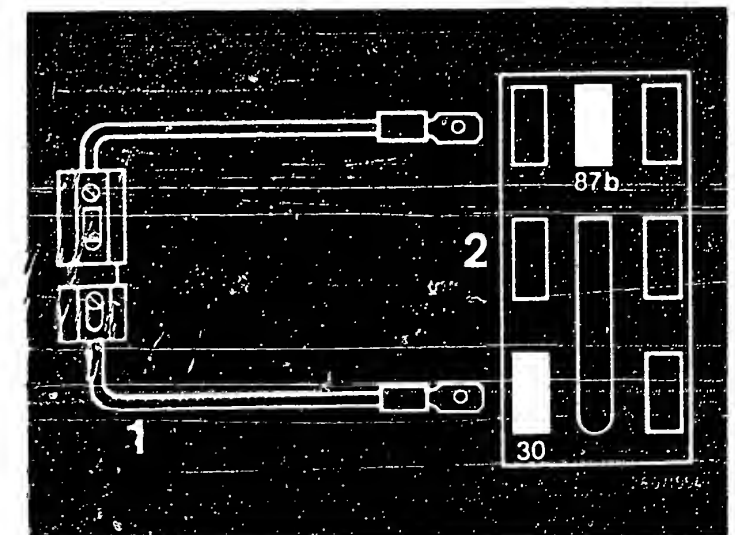
C a r e f u l !

Bridge must always be removed again after testing is completed and the control relay must be re-connected.



Arrow = Solenoid-operated cold-start valve (blue plug)

- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
2 = Top view of connection base (3/5 series until 8.84 similar)



Continued on next picture page

Auxiliary-air device mechanically
O.K.?

N>

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose
pinched off

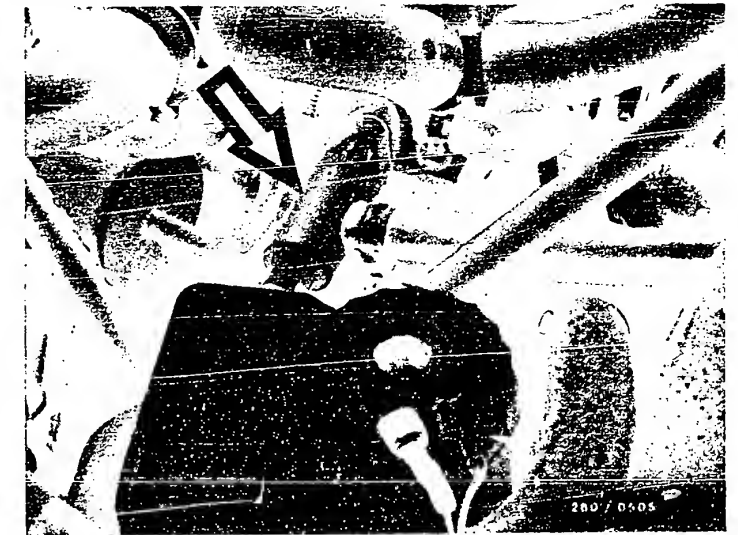
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down
(possibly using a small mirror).
When cold, the cross section must be
partially open; when the engine is
warm, it must be closed. If not,
replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose
to auxiliary-air device. Engine
speed must drop. With engine warm,
pinch off hose to auxiliary-air
device. There must be no noticeable
drop in engine speed. If not,
replace auxiliary-air device (paying
attention to direction of flow).



Arrow = Auxiliary-air device

Continued on next picture page

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

Trouble-shooting program for customer complaint

"engine starts but then dies"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04.
Direct trouble-shooting chart coordinates C05...C08.

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.

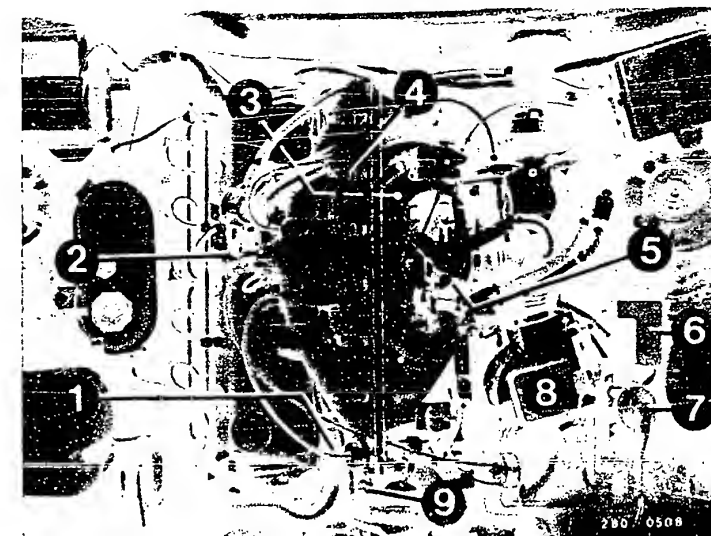
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold. Seal off connection port on auxiliary-air device.

Open throttle valve fully while doing this.

Brush or spray all joints with soapy water.

Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.

Bubbling or foaming indicates a leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

ROUGH IDLE, INCORRECT IDLE SPEED

Trouble-shooting program according to customer complaints

Procedure

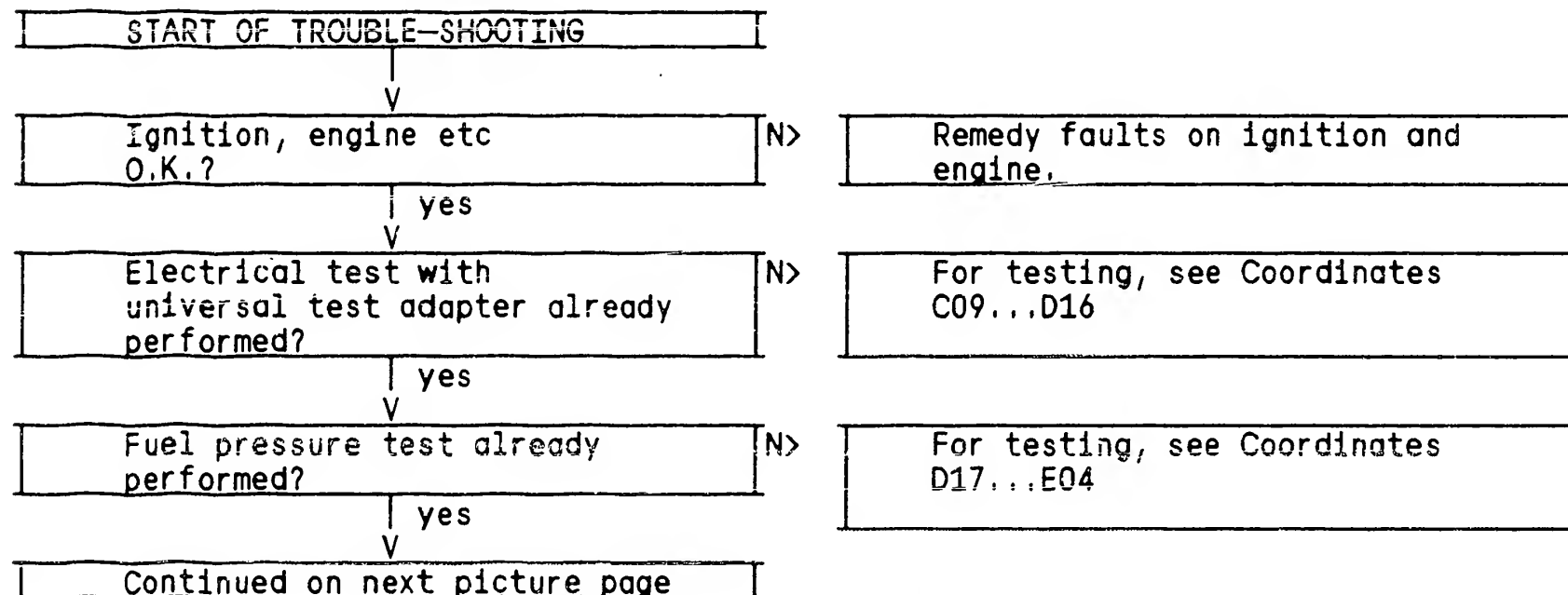
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.

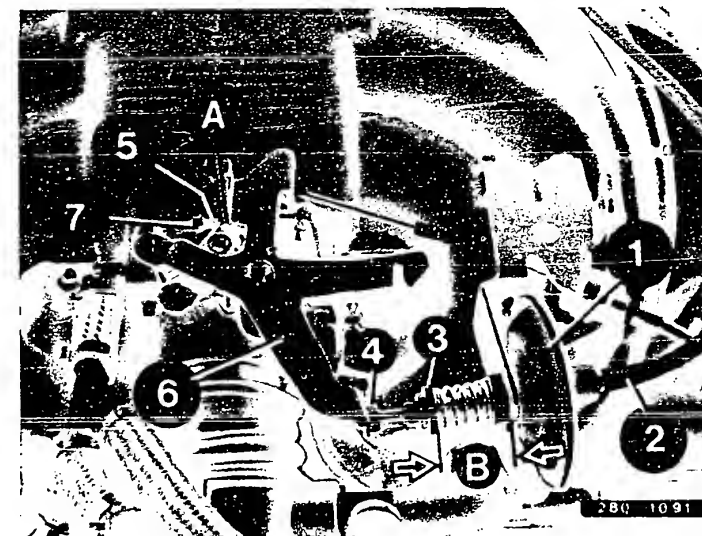


Throttle valve closed?
Engine coughing on overrun?

- * Does throttle lever come up against stop screw? N>
- * Throttle cable free of tension?
- * Throttle cable not kinked?

* Testing and if necessary correcting basic setting of throttle valve

- Remove hose before throttle valve.
- Pull off anti-tamper device (7) and unscrew throttle-valve stop screw (6) until the throttle-plate lever (5) is no longer in contact with the throttle-valve stop screw.
- Put finger on throttle plate.
- Screw in throttle-valve stop screw (5) until the throttle plate starts to move.
- Screw in throttle-valve stop screw (5) another 1/4 turns and replace anti-tamper device (7).
- Secure throttle-valve stop screw with locking paint.
- * If accelerator cable is kinked
-> replace.



- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Nut
- 4 = Screw
- 5 = Throttle-valve stop screw
- 6 = Throttle-valve lever
- 7 = Anti-tamper device

A = Setting dimension 2.8 ± 0.2 mm
B = Spring dimension 33 ± 0.3 mm

Continued on next picture page

Rough idle, incorrect idle speed (continued 2)

Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

N>

* Adjustment

Loosen fastening screws somewhat. Connect ohmmeter between terms. 2 and 18 (lead 9).

Turn throttle-valve switch to the right until the idle contact closes (microswitch clicks audibly).

Reading 0 Ω .

* Adjustment check:

Pull accelerator cable slightly. The idle contact opens (microswitch clicks audibly).

Reading: Infinite Ω .

Is throttle-valve positioner correctly adjusted?

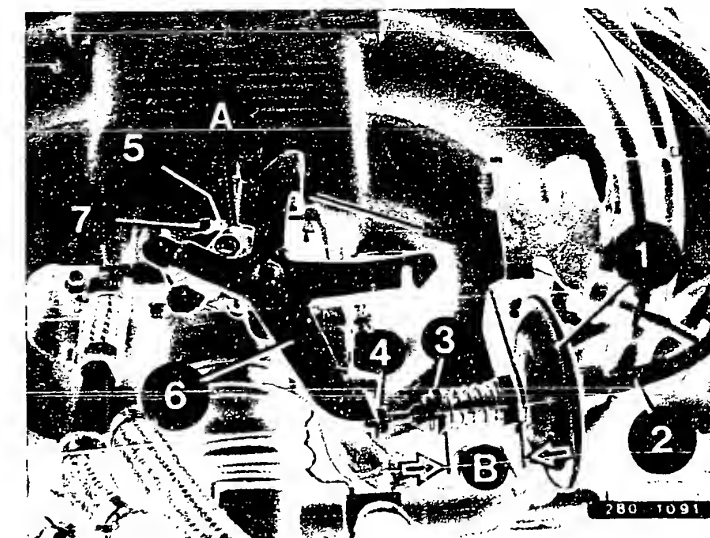
N>

* Adjustment of throttle-valve positioner.

- Remove vacuum hose (2) on throttle-valve positioner (1).
- Set spring dimension B = 32.7... 33.3 mm with nut (3).
- Set setting dimension A = 2.6 ... 3.0 mm with screw (4).
- Dimension "A" is measured between throttle-plate lever (6) and idle stop screw (5).
- After adjustment, replace vacuum hose.

N o t e :

Test engine speed and CO concentration.

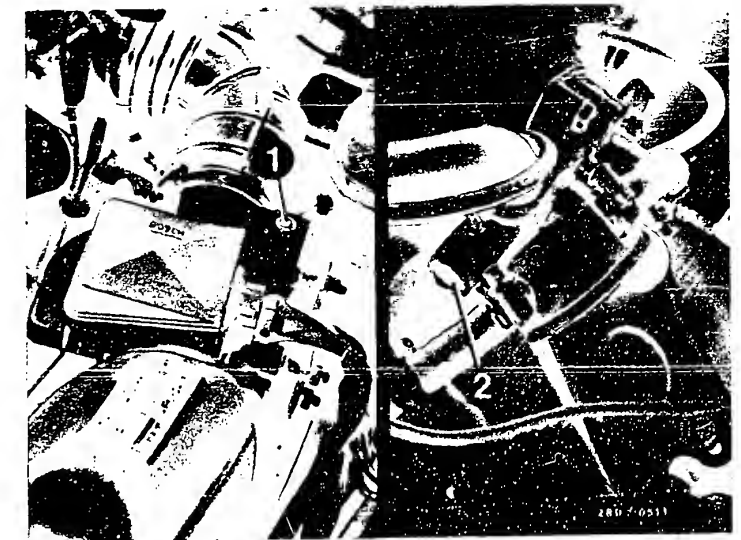
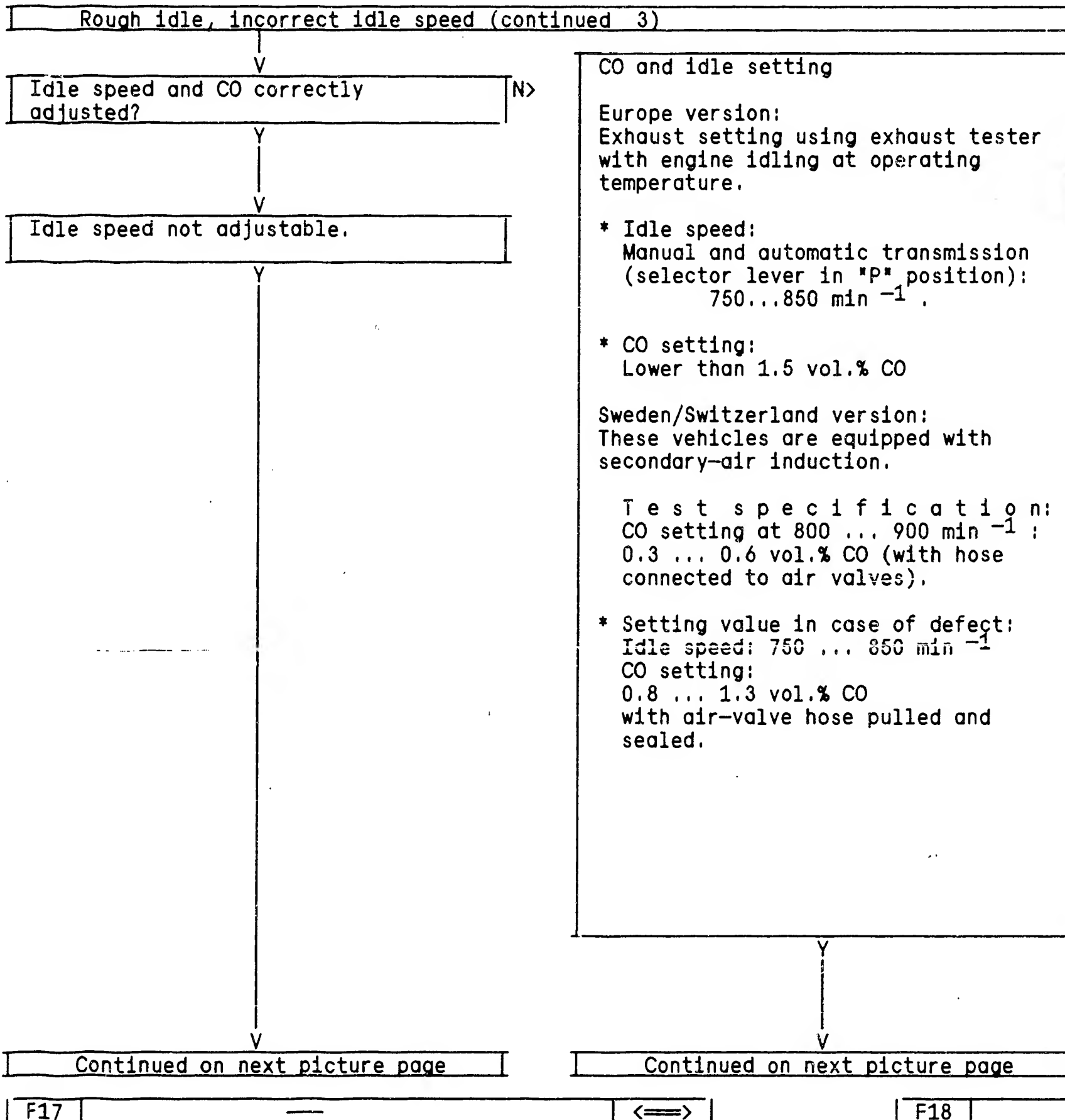


- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Nut
- 4 = Screw
- 5 = Throttle-valve stop screw
- 6 = Throttle-valve lever
- 7 = Anti-tamper device

A = Setting dimension 2.8 ± 0.2 mm

B = Spring dimension 33 ± 0.3 mm

Continued on next picture page



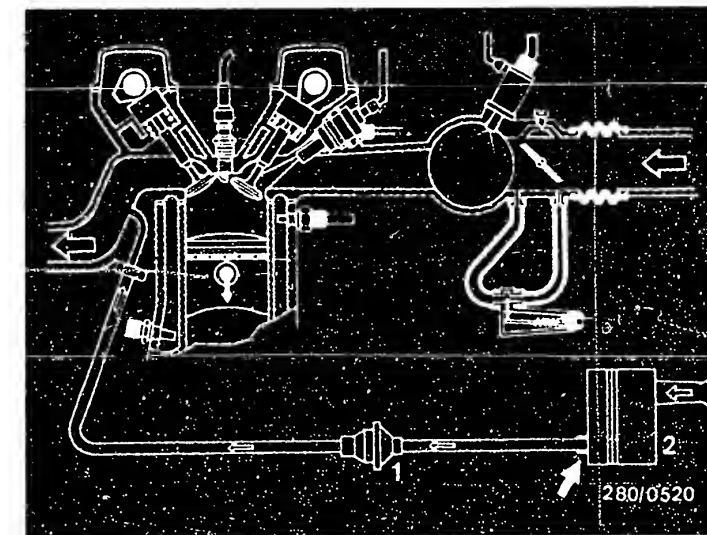
1 = CO-adjusting screw
2 = Idle-speed adjusting screw

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug. Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).

Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).



- 1 = Air valve
(Non-return valve)
- 2 = Air filter

Continued on next picture page

Auxiliary-air device mechanically O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off

N>

Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Continued on next picture page

Is start valve O.K.? (As of 9.84)
(Leak test)

N>

Testing solenoid-operated cold-start
valve for sealing:

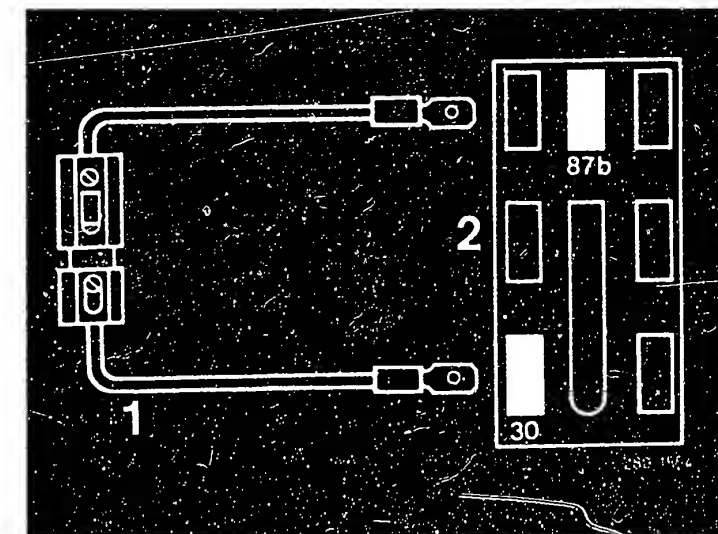
1. In installed condition:
Pinch off fuel delivery line at
start valve. If engine then runs
smoothly, replace the start valve.

2. When removed:
Remove solenoid-operated cold-
start valve (careful: Fire
hazard!). Fuel lines and
electric leads remain connected
(place catch basin underneath
start valve). Generate fuel
pressure (disconnect control
relay, insert cable bridge between
terms. 87b and 30 in connection
base).

Test specification:
Within one minute a maximum of 1
drop may form at the valve
opening.

C a r e f u l !
Bridge must always be removed again
after testing is completed and the
control relay must be re-connected.

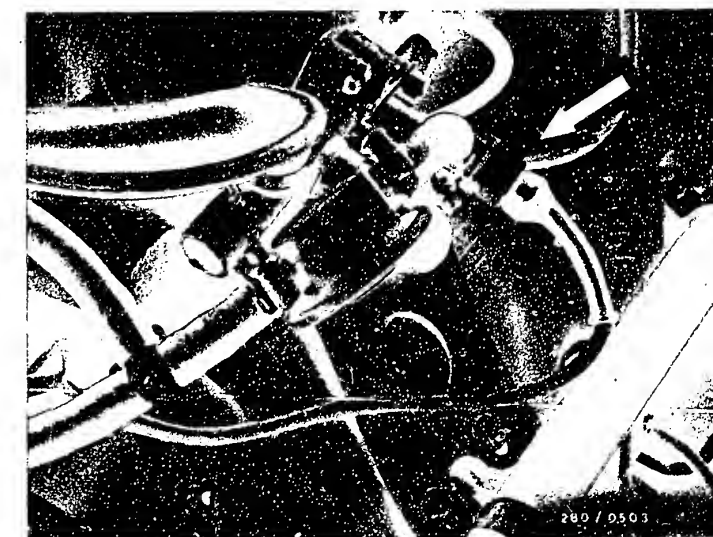
Continued on next picture page



1 = Jumper with fuse bracket and 10 A
fuse (user-fabricated)

2 = Top view of connection base
(3/5 series until 8.84 similar)

Arrow = Solenoid-operated
cold-start valve (blue plug)



Is thermo-time switch O.K?
(N/A as of 9.84)

N>

Electrical testing:

Thermo-time switch 35°C/8 sec.,
test as follows: Pull plug and
measure directly at thermo-time
switch with ohmmeter.

1. Between term. "G" and ground
at ambient temperature
(below +30°C): 25...40 Ω
Engine at operating temperature
(above +40°C): 50...80 Ω
2. Between term. "W" and ground
at ambient temperature
(below +30°C): 0 Ω
Engine at operating temperature
(above +40°C): 100...160 Ω
3. Between terms. "G" and "W" at
ambient temperature
(below +30°C): 25 Ω
Engine at operating temperature
(above +40°C): 50...80 Ω



Arrow = Thermo-time switch
(brown plug)

Continued on next picture page

Injection valves checked for correct operation?

- * Injection pulse without interference or missing?
- * Leads correctly routed?
- * No loose contacts in plug-in connections?

N>

* Connect test lead as follows:
Connect the two-pole plug connections of the test lead between a solenoid-operated injection valve and its connecting lead. Of the other two terminals of the test lead, only one terminal need be connected to the special input of the motortester.

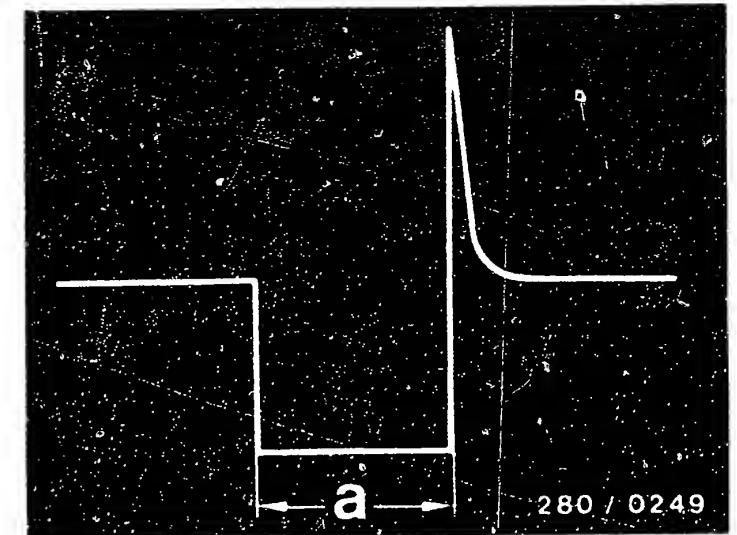
C A U T I O N !

The free terminal must not come into contact with the vehicle body.

* If correctly connected, the pattern shown opposite will be visible on the oscilloscope. With the aid of the test lead it is possible to check the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing etc), the other injection valves should also be examined.

* In case of interference:
check routing of leads.

* In case of missing:
eliminate loose contacts in the leads or in the plug-in connections.



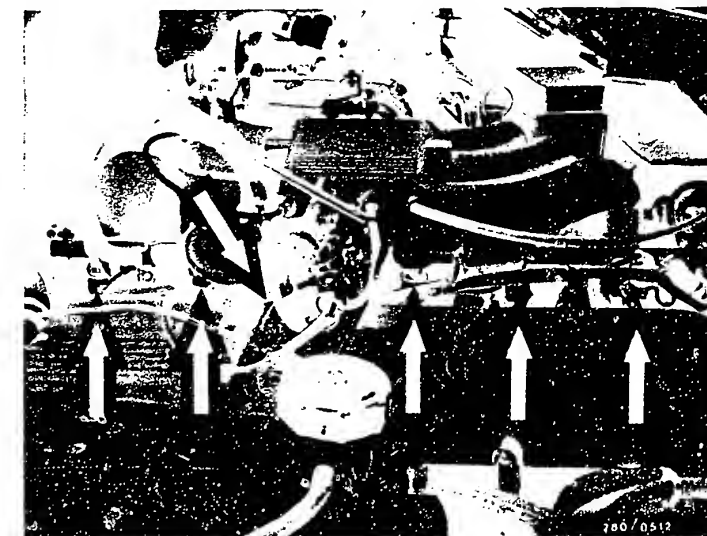
Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

Continued on next picture page

Are solenoid-operated injection valves in good mechanical and hydraulic order?

N>

* Carry out mechanical and hydraulic check of solenoid-operated injection valves:
Let engine run at operating temperature (+80°C). Pull solenoid-operated injection valve plugs individually from the injection valves one after the other and reconnect. Engine speed should:
1. remain almost constant in case of a defective injection valve.
2. sink considerably if the injection valve is good.
Wait until you get a constant engine speed.
Replace any defective solenoid-operated injection valves.



Arrows = Injection valves

Are solenoid-injection valves in good electrical order?

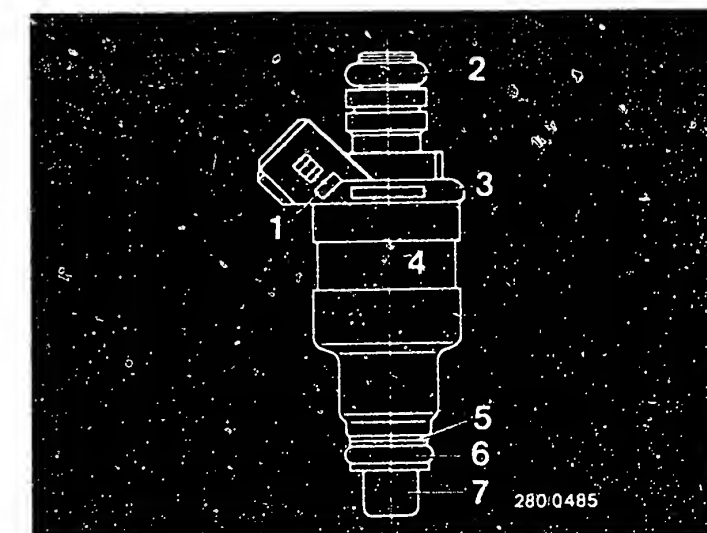
N>

* Carry out electrical test of solenoid-operated injection valves:
Test connecting cable from control relay term. 87 to the individual injection valves and from the injection valves to the control-unit plug term. 12 / term. 27 for continuity using ohmmeter.
Nominal value approx. 0 Ω

Resistance of the individual solenoid-operated injection valves:

0 280 150 208/210:
15 ... 20 Ω
0 280 150 705/716:
14.5...19.5 Ω

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

Repair solenoid-operated injection valves.
O-ring O.K.?

N>

NOTE !

* Replace O-ring:
If solenoid-operated injection valve is changed, the same injection valve must be installed.

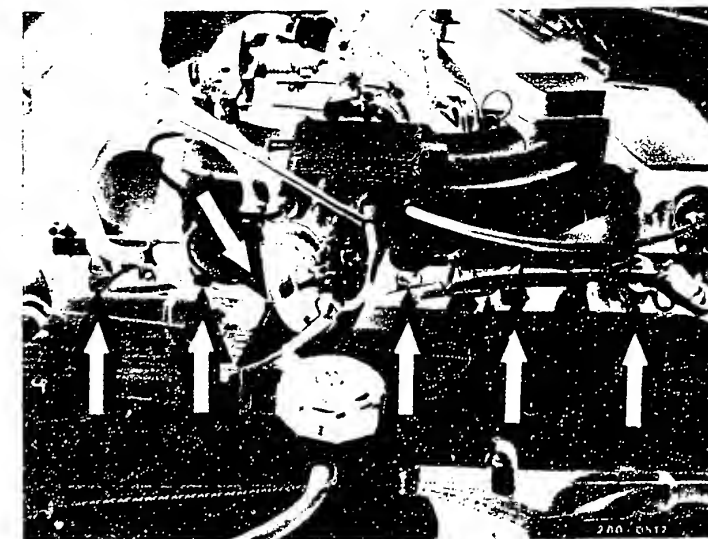
If the injection valves are in good order but the O-rings are defective, proceed as follows:

1. Repair instructions for solenoid-operated injection valve ... 208 as of FD 252 and 210/705 and 716:

Remove fuel-distribution pipe (loosen 2 fastening screws). Disconnect electrical connection. Carefully push the retaining clamp out of the groove and pull the injection valve out of the fuel-distribution pipe.

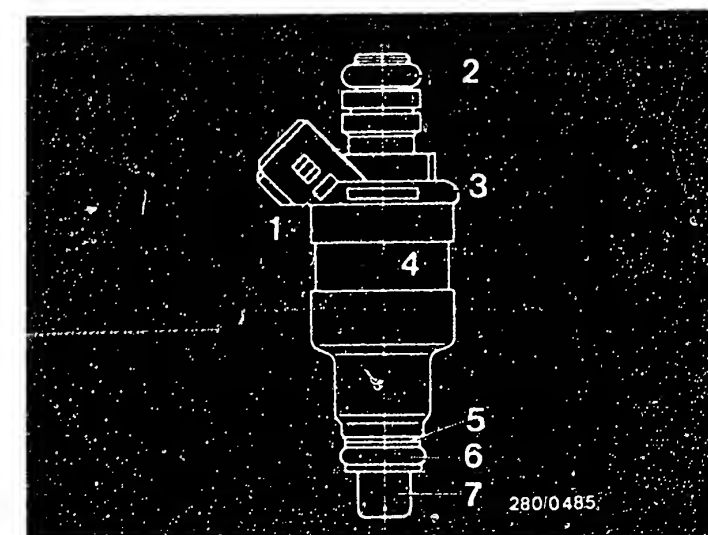
CAREFUL !

Catch escaping fuel. Do not allow to drip onto hot engine parts (fire hazard!). Protection sleeves must not be pried off.



Arrows = Injection valves

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

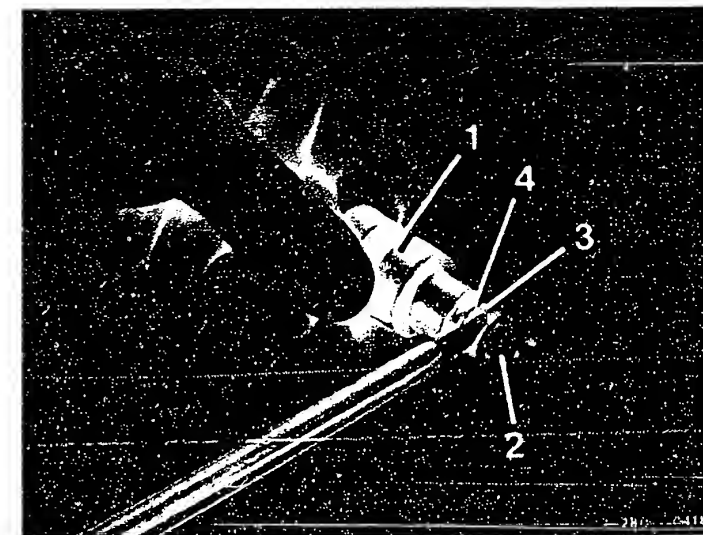
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Cut up lower O-ring (intake manifold).

Careful!
Do not damage protection sleeve.
Pull a new O-ring over the protection sleeve and its shoulder.
Be careful not to damage any parts.

Use parts set 1 287 010 704.

When working on the solenoid-operated injection valves do not damage the valve needles. If the upper O-ring (on fuel-distribution pipe connection) is swollen or damaged it must be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

Continued on next picture page

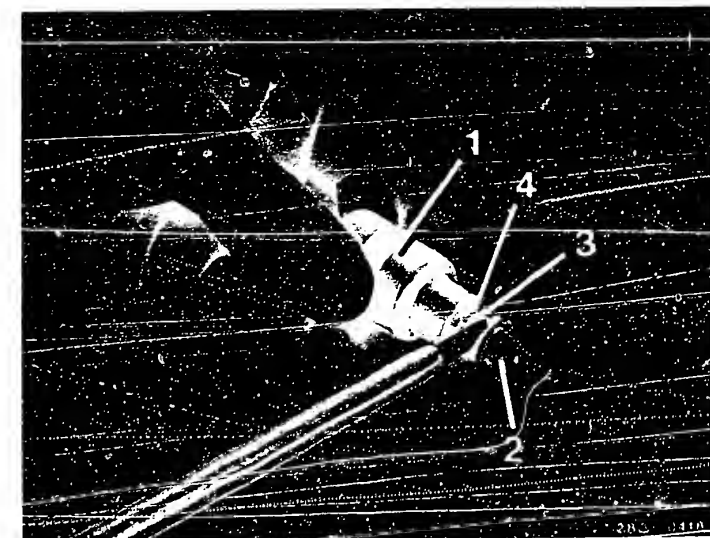
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2. Repair instructions only for solenoid-operated injection valve .. 208 to FD (date of manufacture) 251: Replace protection sleeve or O-ring. Remove fuel-distribution pipe. Pull electrical connection. Carefully push retaining clip out of groove and pull injection valve out of fuel-distribution pipe.

C a r e f u l !

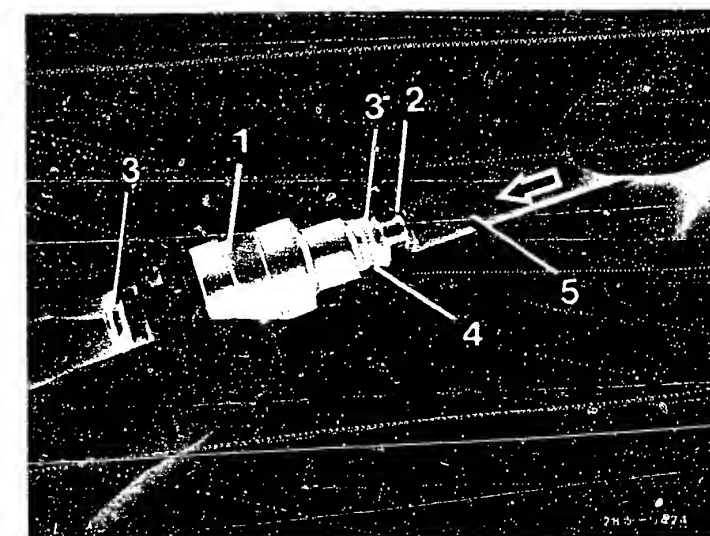
Catch any fuel running out. Do not allow fuel to drop onto hot engine parts. Carefully pry off protection sleeve.

Careful! Do not damage protruding injection-valve needles. Pry off lower O-ring (3). Use parts set 1 287 010 704. Pull on lower O-ring (3) and carefully push on a new protection sleeve with user-fabricated pipe section (approx. 120 mm long with inside diameter of 10 mm). Do not damage injection-valve needles. If the O-ring (fuel-distribution-pipe connection) is swollen, it must also be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

- 1 = Solenoid-operated injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe connection



Continued on next picture page

Continued on next picture page

Rough idle, incorrect idle speed (continued 13)

V

General:

Careful!

The two O-rings must be only lightly lubricated prior to installation with clean engine oil, e.g. HD30.

The remaining solenoid-operated injection valve parts must remain oil-free.

Careful!

After testing, restore to original installed condition.

V

Continued on next picture page

G09

<==>

G10

<==>

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60 ...1000 Ω

Testing:

Loosen clamp fasteners on air filter, lift off air filter upper section.

- * Test sensor flap for freedom of motion:

Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.

- * Mechanical test of air-flow sensor:

Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

Upper illustration: 3201/ 3231:

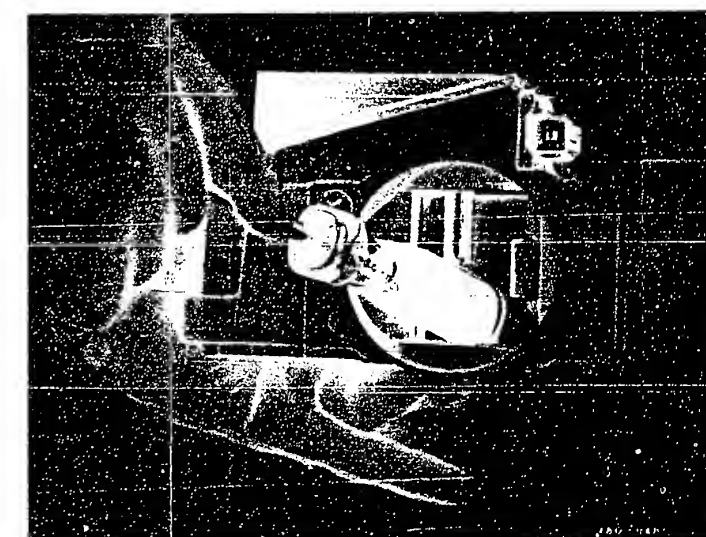
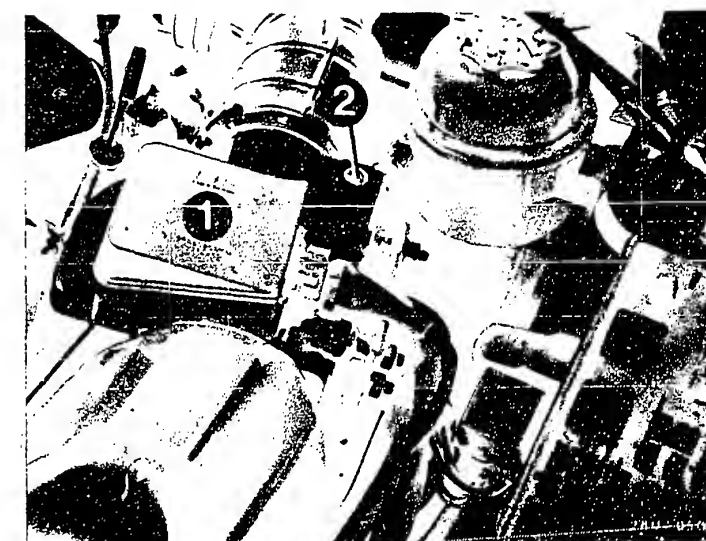
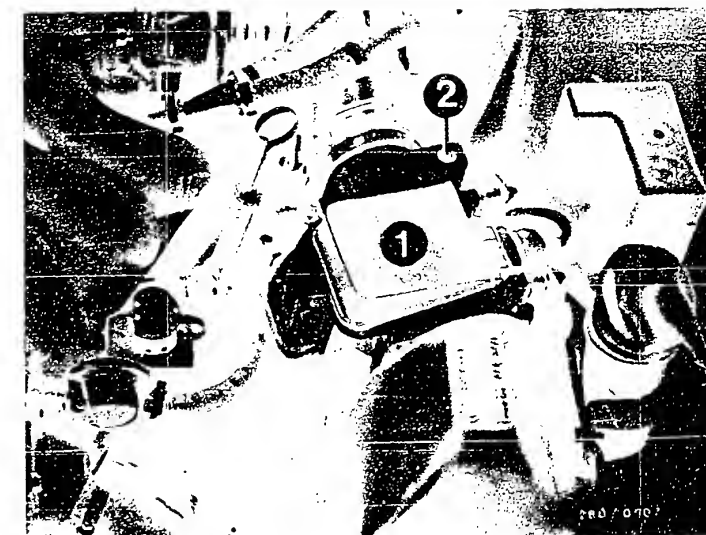
- 1 = Air-flow sensor
- 2 = CO adjusting screw

Middle illustration: 5201:

- 1 = Air-flow sensor
- 2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Continued on next picture page



* Check resistances:

Connect ohmmeter to terms. 8 and 9 of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and 5 of the air-flow sensor. Deflect sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air filter and air-flow sensor must be re-assembled.

Upper illustration: 3201 / 3231:

1 = Air-flow sensor

2 = CO adjusting screw

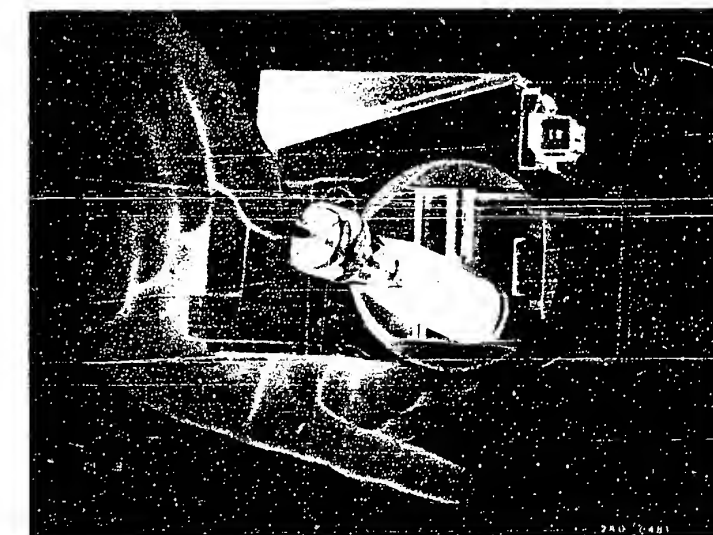
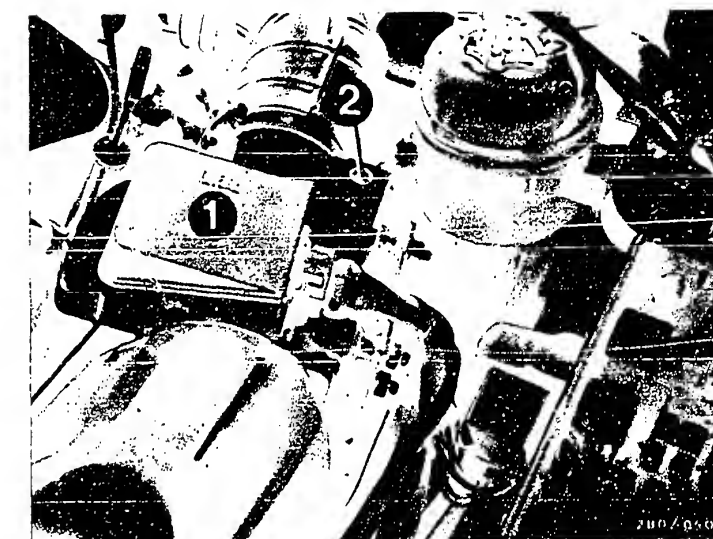
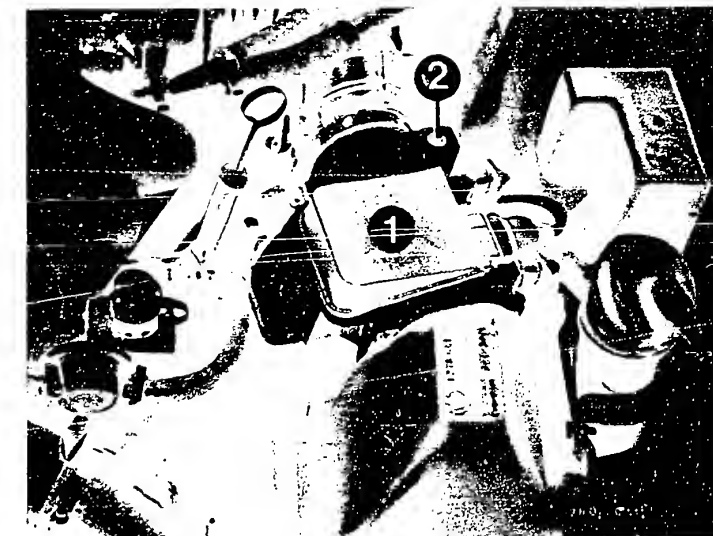
Middle illustration: 5201:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Rough idle, incorrect idle speed (continued 16)

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.

Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.

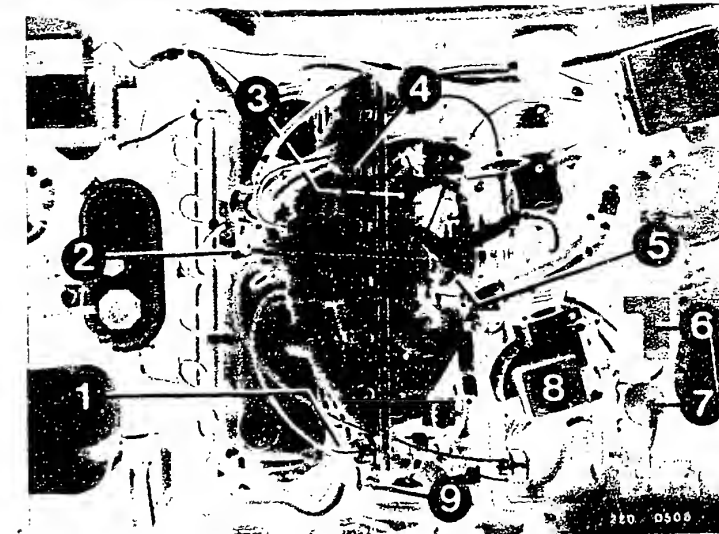
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold. Seal off connection port on auxiliary-air device.

Open throttle valve fully while doing this.

Brush or spray all joints with soapy water.

Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.

Bubbling or foaming indicates a leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

Continued on next picture page

Continued on next picture page

Rough idle, incorrect idle speed (continued 17)

V

Sweden/Switzerland version

Secondary-air induction is installed here as an additional measure for reducing pollutants in the exhaust.

* Leak test:

In addition, the lines for the secondary-air induction must be inspected along with the air valves.

V

Continued on next picture page

G17

<==>

G18

<==>

Rough idle, incorrect idle speed (continued 18)

Are CO and idle speed correctly set?

Test specification:

Idle speed:
750...850 min⁻¹

CO concentration

Europe:
less than 1.5 vol. % CO
Sweden/Switzerland version:
0.3 ... 0.6 vol. % CO.

Are specifications reached?

N>

CO and idle setting

Europe version:
Exhaust setting using exhaust tester
with engine idling at operating
temperature.

* Idle speed:
Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹.

* CO setting:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
These vehicles are equipped with
secondary-air induction.

Test specification:
CO setting at 800 ... 900 min⁻¹ ;
0.3 ... 0.6 vol.% CO (with hose
connected to air valves).

* Setting value in case of defect:
Idle speed: 750 ... 850 min⁻¹
CO setting:
0.8 ... 1.3 vol.% CO
with air-valve hose pulled and
sealed.

Idle speed not adjustable.

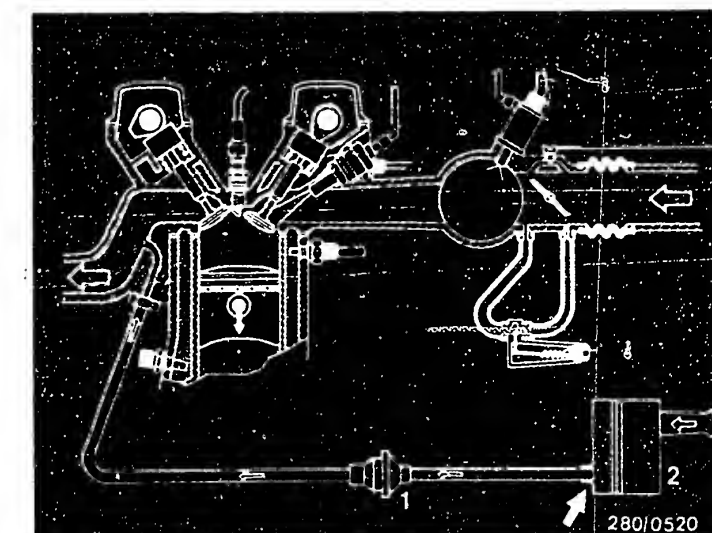
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1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



Trouble-shooting program for customer complaint

"rough idle, incorrect idle speed"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04.
Direct trouble-shooting chart coordinates C05...C08.

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug. Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

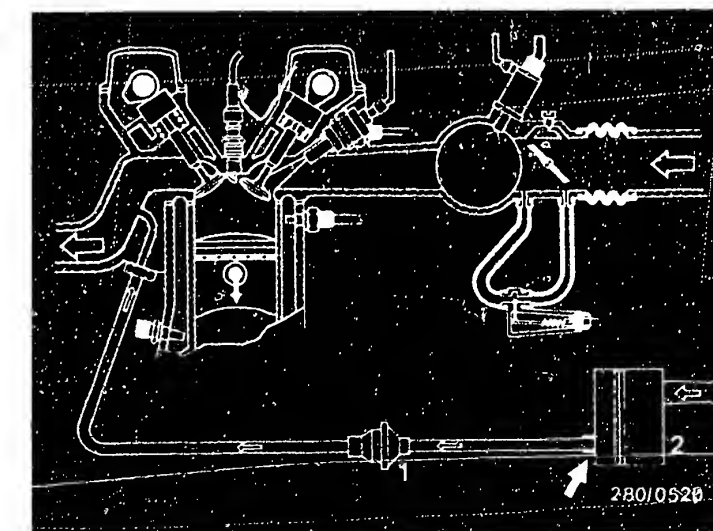
If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).

Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve (non-return valve)
2 = Air filter



POOR THROTTLE TAKE-UP

Trouble-shooting program according to customer complaints

Procedure

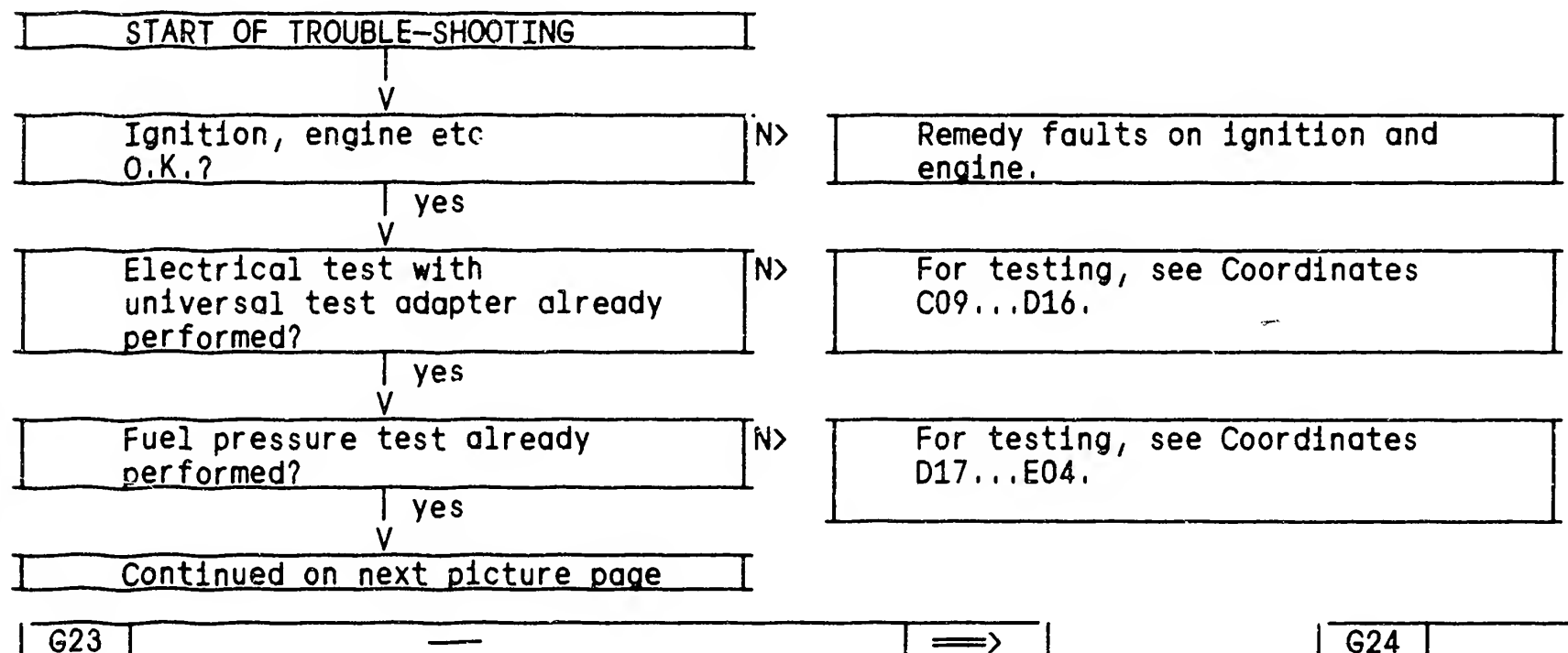
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



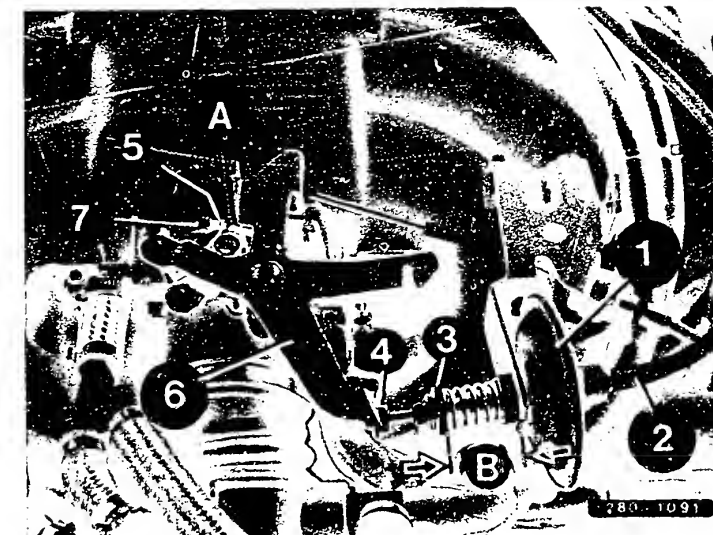
Poor throttle take-up (continued 1)

Throttle valve closed?
Engine coughing on overrun?

- * Does throttle lever come up against stop screw?
- * Throttle cable free of tension?
- * Throttle cable not kinked?

* Testing and if necessary correcting basic setting of throttle valve

- Remove hose before throttle valve.
- Pull off anti-tamper device (7) and unscrew throttle-valve stop screw (6) until the throttle-plate lever (5) is no longer in contact with the throttle-valve stop screw.
- Put finger on throttle plate.
- Screw in throttle-valve stop screw (5) until the throttle plate starts to move.
- Screw in throttle-valve stop screw (5) another 1/4 turns and replace anti-tamper device (7).
- Secure throttle-valve stop screw with locking paint.
- * If accelerator cable is kinked
→ replace.



- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Nut
- 4 = Screw
- 5 = Throttle-valve stop screw
- 6 = Throttle-valve lever
- 7 = Anti-tamper device

A = Setting dimension 2.8 ± 0.2 mm
B = Spring dimension 33 ± 0.3 mm

Continued on next picture page

Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

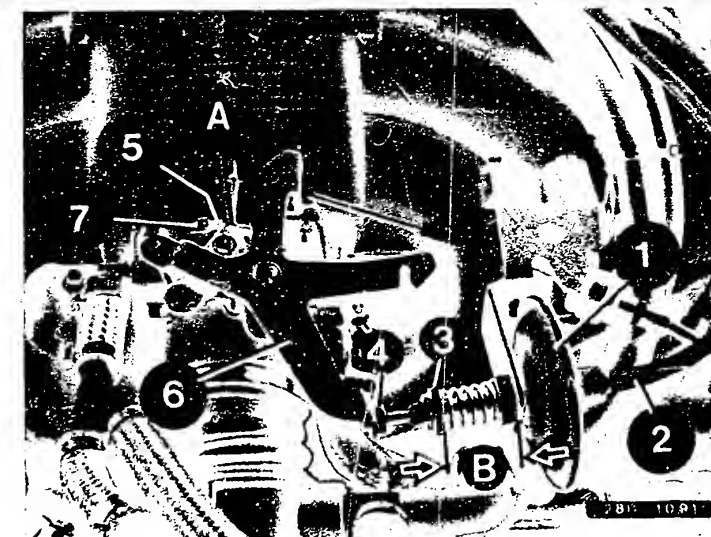
N>

- * Adjustment
Loosen fastening screws somewhat. Connect ohmmeter between terms. 2 and 18 (lead 9). Turn throttle-valve switch to the right until the idle contact closes (microswitch clicks audibly).
Reading 0 Ω .
- * Adjustment check:
Pull accelerator cable slightly. The idle contact opens (microswitch clicks audibly).
Reading: Infinite Ω .

Is throttle-valve positioner correctly adjusted?

N>

- * Adjustment of throttle-valve positioner.
 - Remove vacuum hose (2) on throttle-valve positioner (1).
 - Set spring dimension B = 32.7... 33.3 mm with nut (3).
 - Set setting dimension A = 2.6 ... 3.0 mm with screw (4).
 - Dimension "A" is measured between throttle-plate lever (6) and idle stop screw (5).
 - After adjustment, replace vacuum hose.
- N o t e :
Test engine speed and CO concentration.



- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 3 = Nut
- 4 = Screw
- 5 = Throttle-valve stop screw
- 6 = Throttle-valve lever
- 7 = Anti-tamper device

- A = Setting dimension 2.8 ± 0.2 mm
- B = Spring dimension 33 ± 0.3 mm

Continued on next picture page

Poor throttle take-up (continued 3)

Auxiliary-air device mechanically O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off

N>

Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

N>

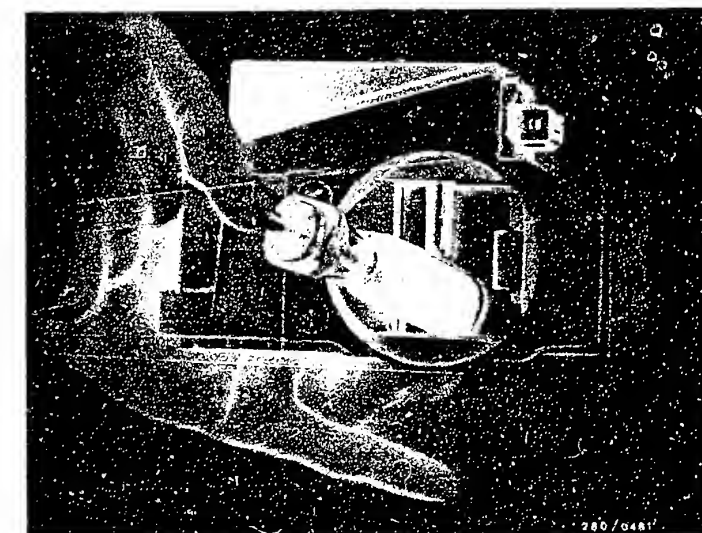
Testing:

Loosen clamps on air filter. Lift off air filter.

- * Check sensor flap for ease of motion:

Open sensor flap by hand. Sensor plate must be able to be moved all the way to the stop with consistent ease and must close itself back to stop. The sensor flap must not catch when opening.

Opening the air-flow sensor flap

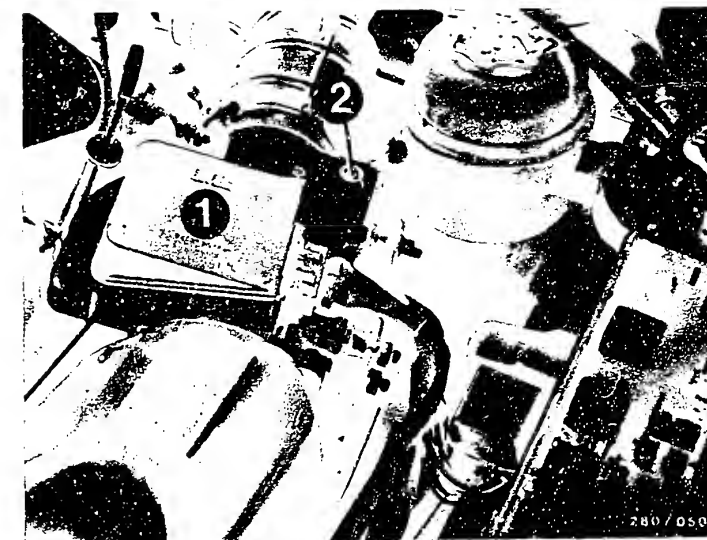


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- ↓
- * Mechanical test of air-flow sensor:
Look for signs of wear. Clean interior of severely dirty air-flow sensor and rub out with a lint-free cloth. If signs of wear are present the air-flow sensor must be exchanged.
 - * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent, and the air-flow sensor must be replaced.
 - * Test resistances:
Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160... 300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap. Test specification: 60...1000 Ω

N o t e !
After testing has been completed,
the air filter and air-flow
sensor m u s t be re-assembled.



5201

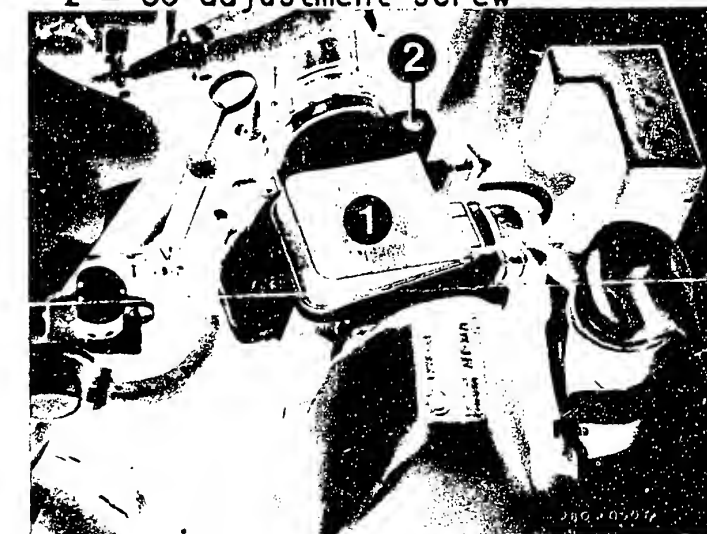
1 = Air-flow sensor

2 = CO adjustment screw

3201 / 3231:

1 = Air-flow sensor

2 = CO adjustment screw



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Test of potentiometer:
(Noise test)

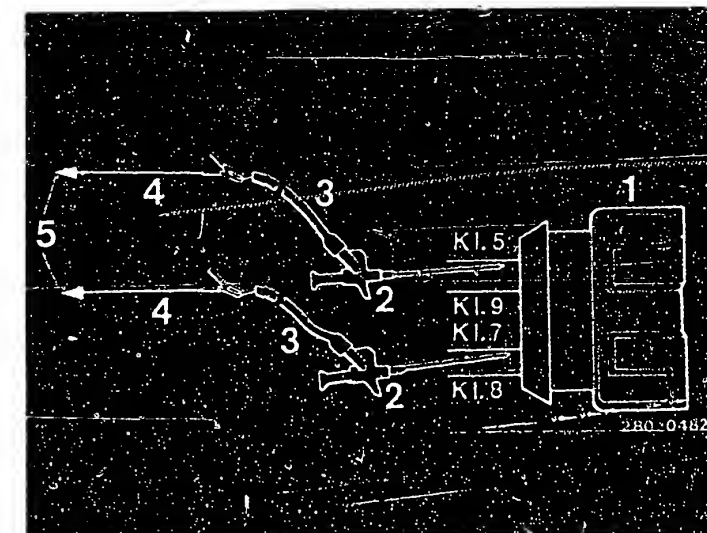
* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motortester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

* Making the adapter lead:
two approx. 1 m long leads approx. 1.0 mm ² cross section and 10 A fuse. Secure at one end. At the other end, strip off approx. 2 cm of insulation and connect to the terminals of the special-input connecting lead.

C A U T I O N !

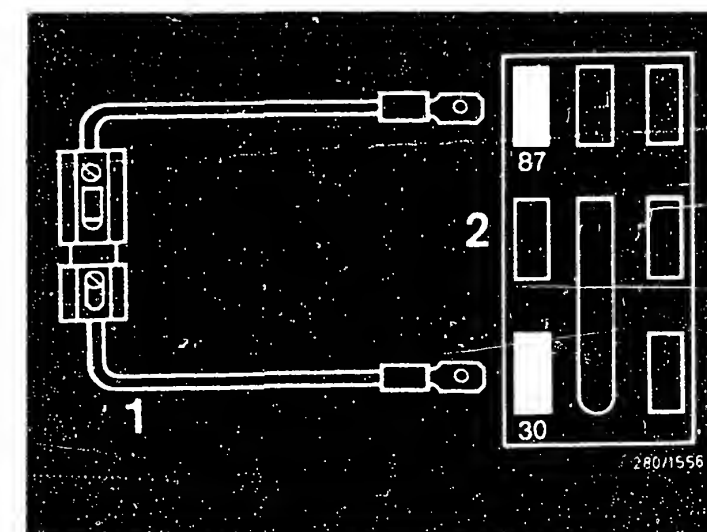
Insulate bare connecting points of adapter lead (danger of short circuit). Carefully measure into the plug of the air-flow sensor. Do not bend any connecting springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

* Disconnect control relay. Connect jumper in connection base between term. 87 and term. 30. (Power supply from control unit).



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (User-fabricated)
- 4 = Special input connecting lead
- 5 = Motortester special input

- 1 = Cable bridge with 10 A fuse (user-fabricated)
- 2 = Top view of plug base (3/5-series models 9.84 similar)



Continued on next picture page

Continued on next picture page



* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous signal must be visible on the oscilloscope.

If air-flow sensor defective, a noise signal appears, similar to the one shown opposite.
Replace air-flow sensor.

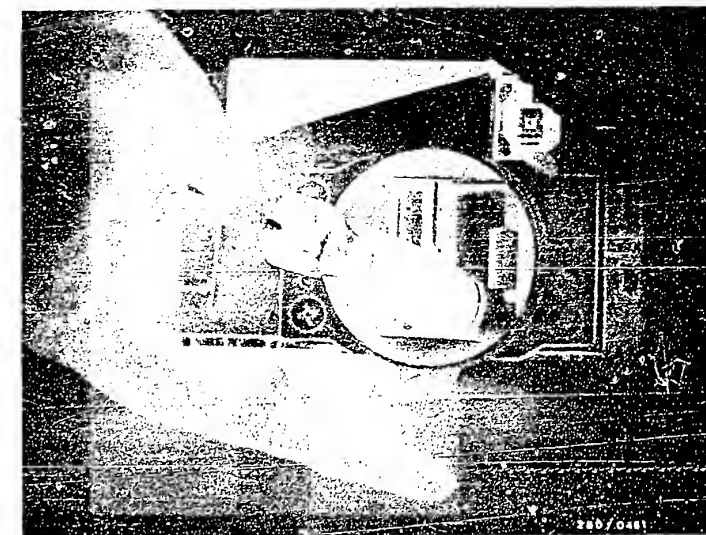
Disconnect adapter lead after testing and push on rubber sleeve properly.

Mount air-flow sensor.

Connect all hoses and tighten (no leaks).

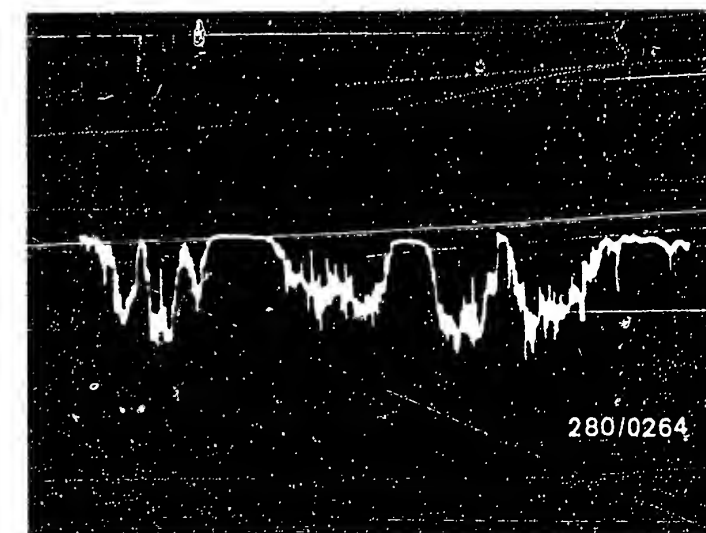
C A U T I O N !

After testing, remove jumper and connect control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



Continued on next picture page

Is there an absence of bucking during acceleration with engine at operating temperature?

Is pressure switch for part-load enrichment O.K.?

3231	as of 2.83	until 8.84
3201	as of 3.83	until 8.84
5201	as of 9.83	until 8.84

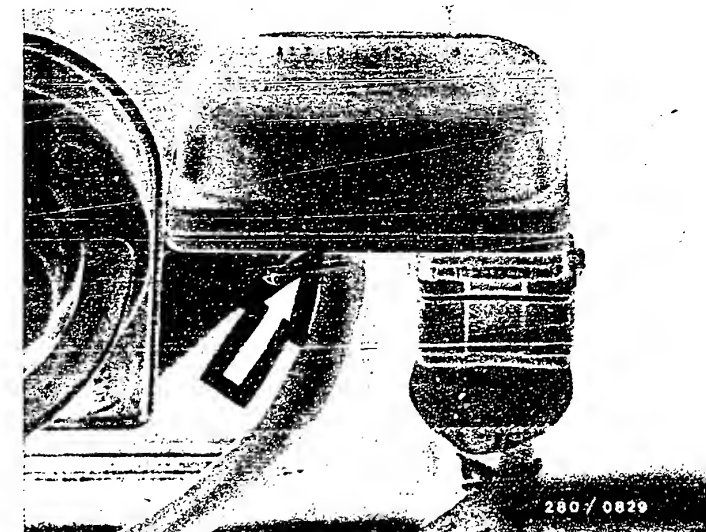
Testing:

- Connect exhaust-gas analyzer.
- Allow engine to run at operating temperature.
- Pull hose at pressure switch and seal.
- CO concentration should arise (approx. 2.5 vol.% CO).

Testing O.K.?

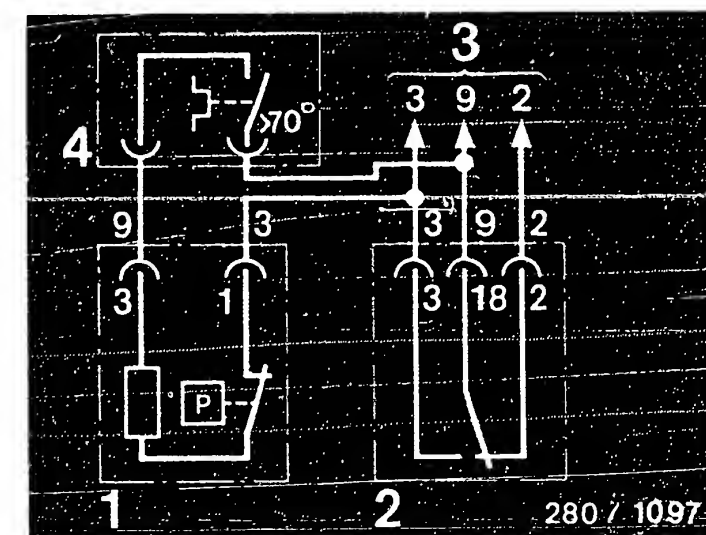
Continue trouble-shooting. If not, test electrical connection leads for continuity (nominal resistance approx. 0 Ω):

- From throttle-valve switch to pressure switch term. no. 1
- From throttle-valve switch term. 18, lead 9 to thermo-switch 70°C and further to pressure switch term. no. 3.
- Resistance at pressure switch between terms. 3 and 1 approx. 30 k Ω .
- Test vacuum hose for sealing.



Arrow = Pressure switch

- 1 = Pressure switch
- 2 = Throttle-valve switch
- 3 = To control-unit plug terms. 3/9/2
- 4 = Thermo-switch 70°C



Continued on next picture page

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.

Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.

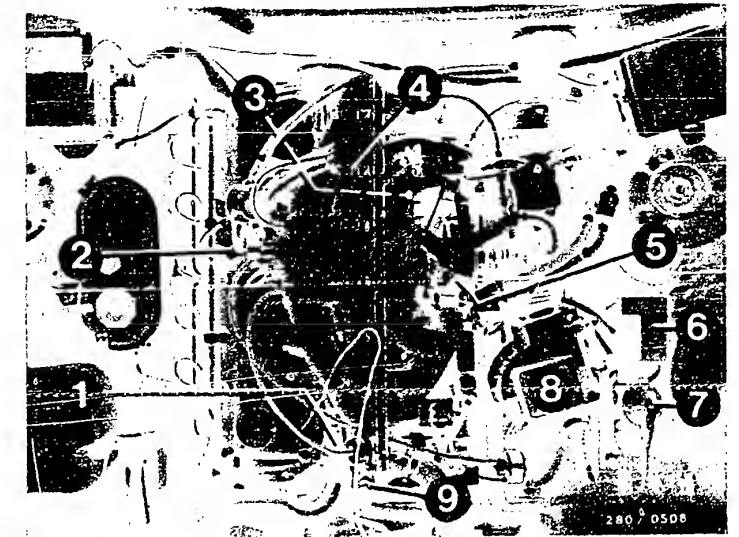
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold. Seal off connection port on auxiliary-air device.

Open throttle valve fully while doing this.

Brush or spray all joints with soapy water.

Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.

Bubbling or foaming indicates a leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

Continued on next picture page

Continued on next picture page

V

Sweden/Switzerland version

Secondary-air induction is installed here as an additional measure for reducing pollutants in the exhaust.

* Leak test:

In addition, the lines for the secondary-air induction must be inspected along with the air valves.

V

Continued on next picture page

Poor throttle take-up (continued 10)

Are CO and idle speed correctly set?

Test specification:

Idle speed:
750...850 min⁻¹

CO concentration

Europe:
less than 1.5 vol. % CO
Sweden/Switzerland version:
0.3 ... 0.6 vol. % CO.

Are specifications reached?

Idle speed not adjustable.

Continued on next picture page

CO and idle setting

Europe version:
Exhaust setting using exhaust tester
with engine idling at operating
temperature.

* Idle speed:
Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹.

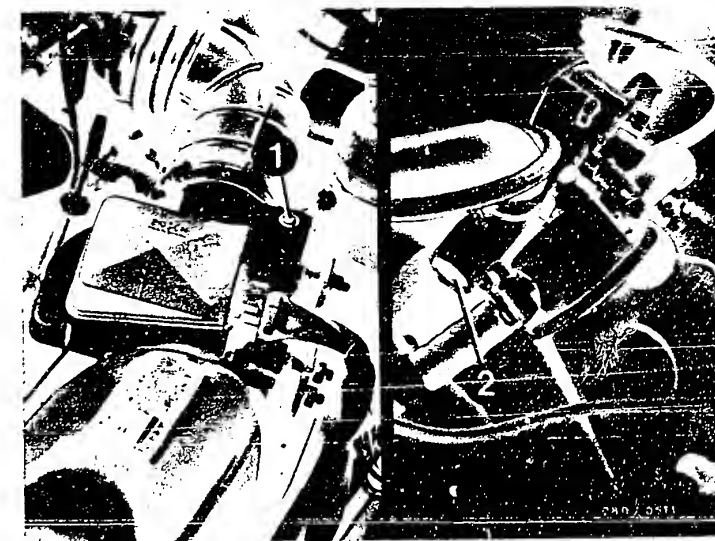
* CO setting:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
These vehicles are equipped with
secondary-air induction.

Test specification:
CO setting at 800 ... 900 min⁻¹ ;
0.3 ... 0.6 vol.% CO (with hose
connected to air valves).

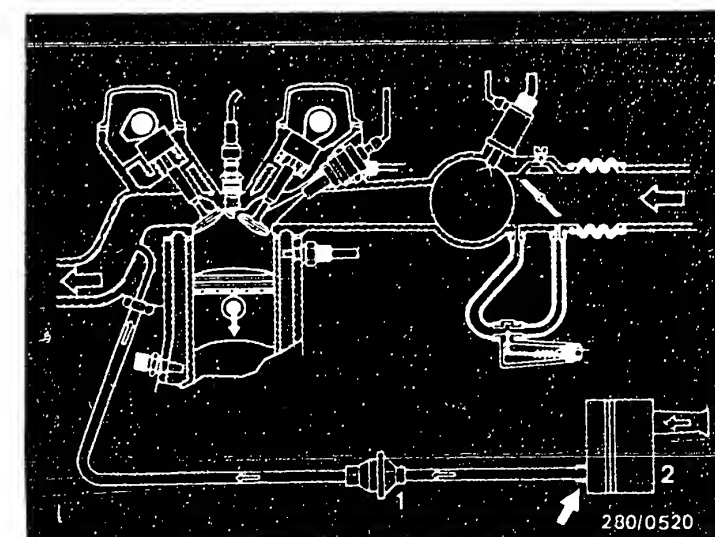
* Setting value in case of defect:
Idle speed: 750 ... 850 min⁻¹
CO setting:
0.8 ... 1.3 vol.% CO
with air-valve hose pulled and
sealed.

Continued on next picture page



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug. Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm). Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).

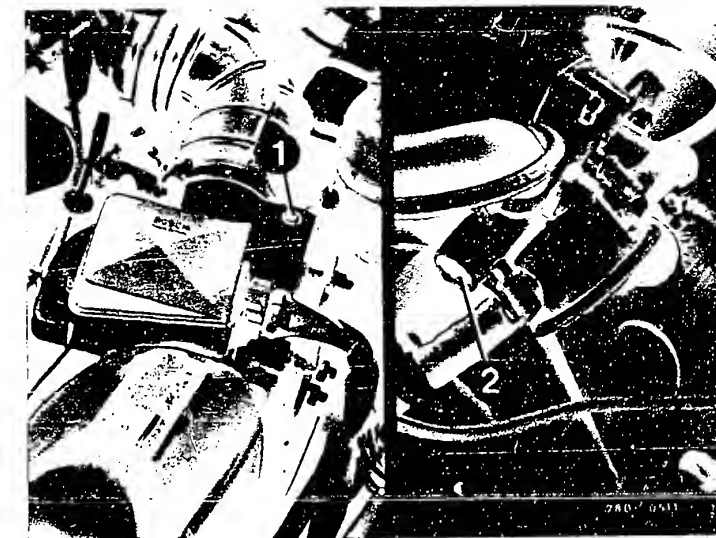
Trouble-shooting program for customer complaint

"poor throttle take-up"

completed.

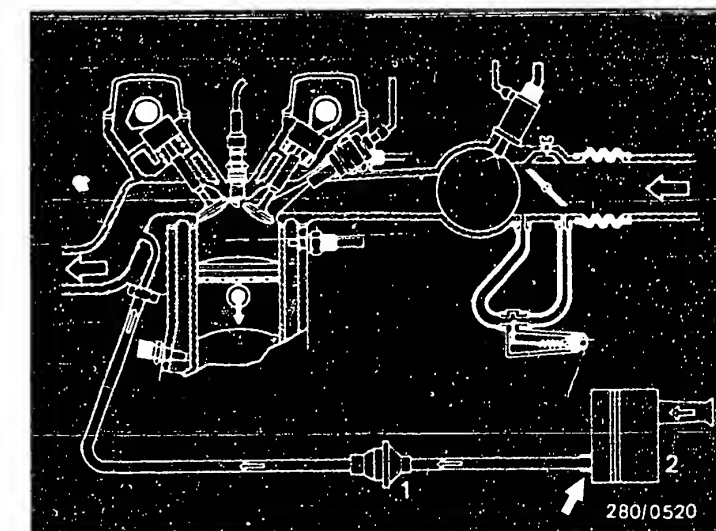
If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04.
Direct trouble-shooting chart coordinates C05...C08.



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve (non-return valve)
2 = Air filter



ENGINE MISSING UNDER ALL OPERATING CONDITIONS

Trouble-shooting program according to customer complaints

Procedure

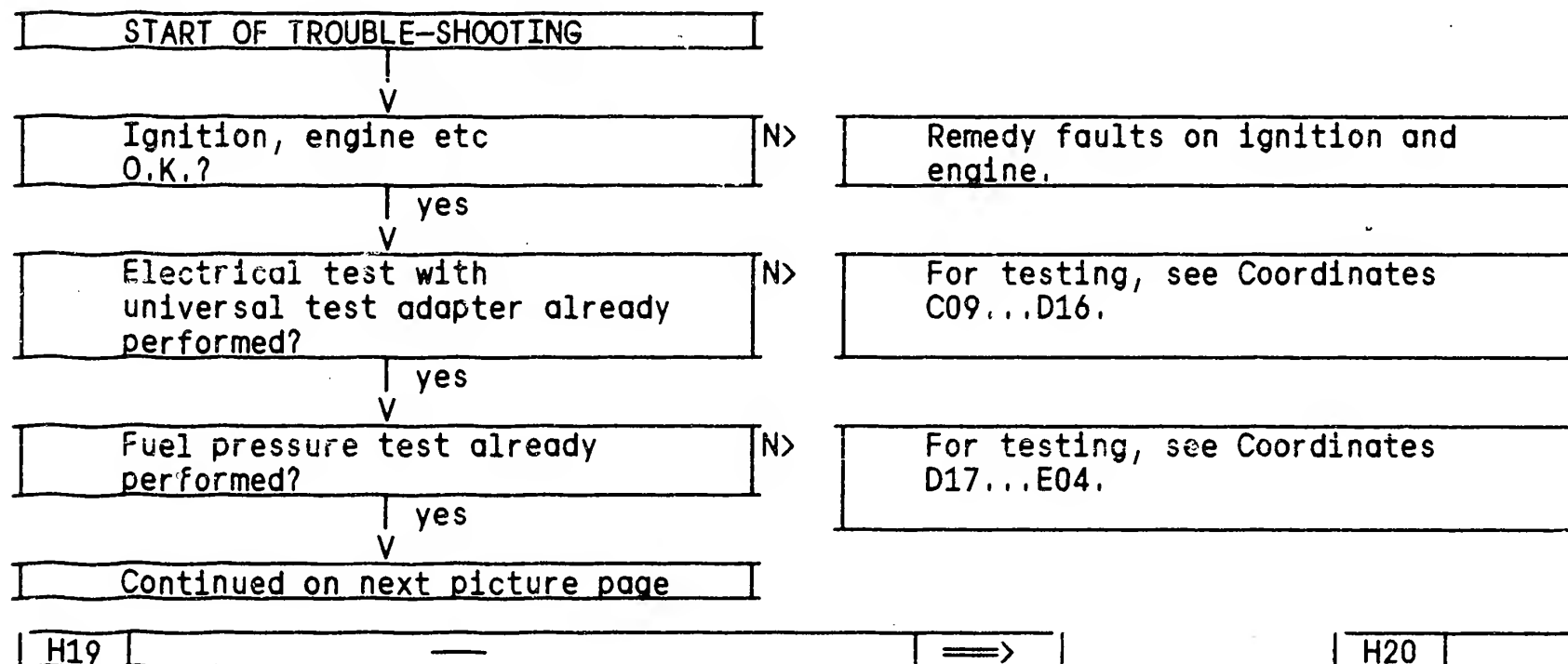
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Engine missing under all operating conditions (continued 1)

Is plug connection of Jetronic wiring harness O.K.?

Loose contacts?
Ground contact?

N>

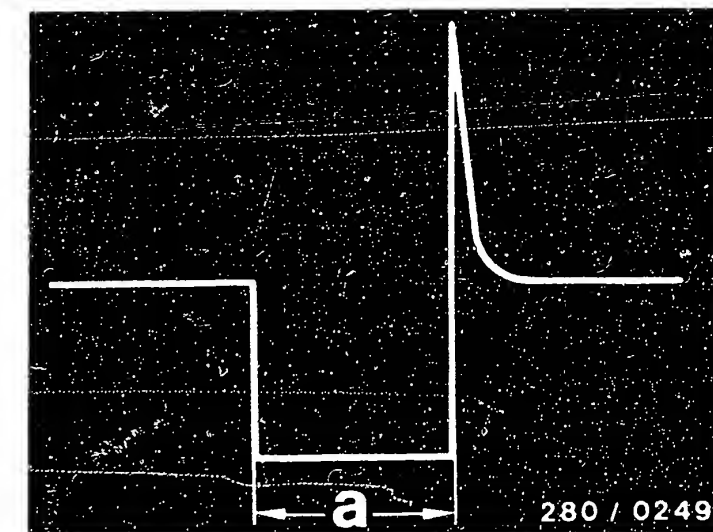
Check all plug connections for correct seating and for corrosion. Pay attention to good ground connection (terminals 5, 38, 13, 25, and 56) (above auxiliary-air device)

Alternator with regulator O.K.?

N>

* Engine not missing due to voltage spikes?

- * Connect test cable: Connect two-pin plug connector between a solenoid-operated injection valve and its connecting lead. Of the other two connection terminals only one terminal should be connected to a motor tester special input. The other terminal must not come into contact with ground. With correct connection and the engine running the injection pulses will look like the upper illustration. If the injection-pulse pattern is not obtained or if interference, engine misfires, etc. can be seen, the other injection valves should be tested as well.
- * With the engine switched off, pull the plug from the generator. Start engine. If misfires have been eliminated, test generator and regulator. Voltage peaks are visible on the ignition oscilloscope.
- * In case of interference -> check cable routing.
- * In case of misfires -> eliminate loose contacts in leads or plug connections.



Injection pulse of a switched output stage (measured at solenoid-operated injection valve)
a = Pulse width (dependent on engine loading)

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

Testing:

Loosen clamp fasteners on air filter, lift off air filter upper section.

- * Test sensor flap for freedom of motion:

Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.

- * Mechanical test of air-flow sensor:

Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

Upper illustration: 3201/ 3231:

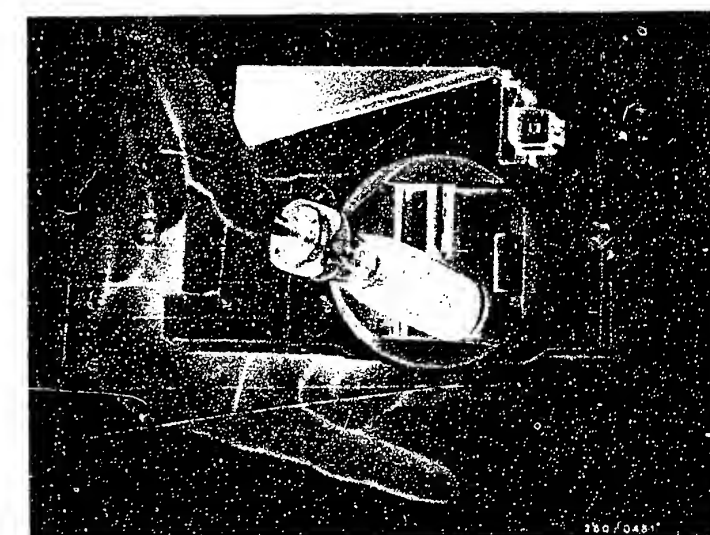
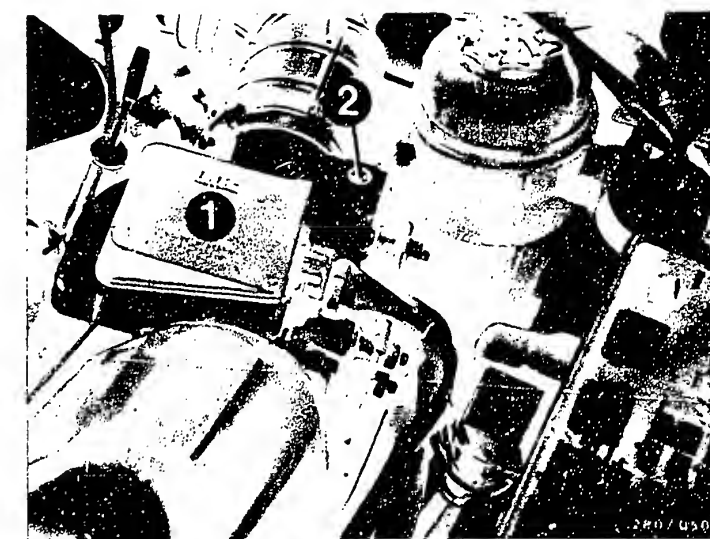
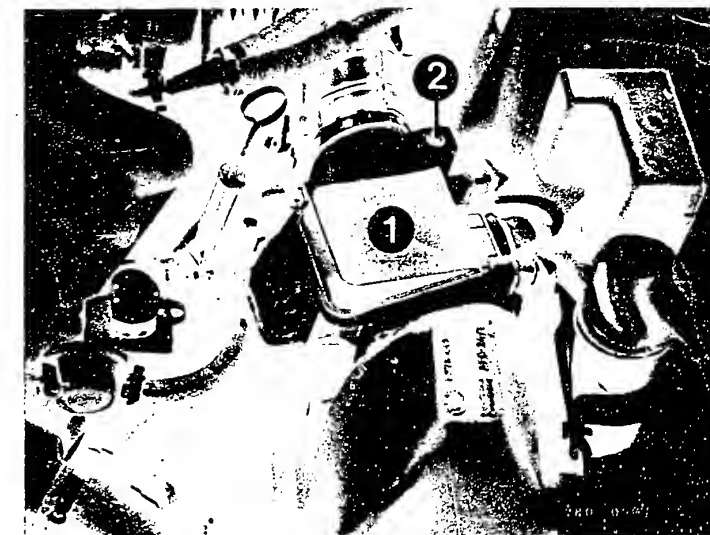
- 1 = Air-flow sensor
- 2 = CO adjusting screw

Middle illustration: 5201:

- 1 = Air-flow sensor
- 2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Continued on next picture page

* Check resistances:

Connect ohmmeter to terms. 8 and 9 of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and 5 of the air-flow sensor. Deflect sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air filter and air-flow sensor m u s t be re-assembled.

Upper illustration: 320i / 323i:

1 = Air-flow sensor

2 = CO adjusting screw

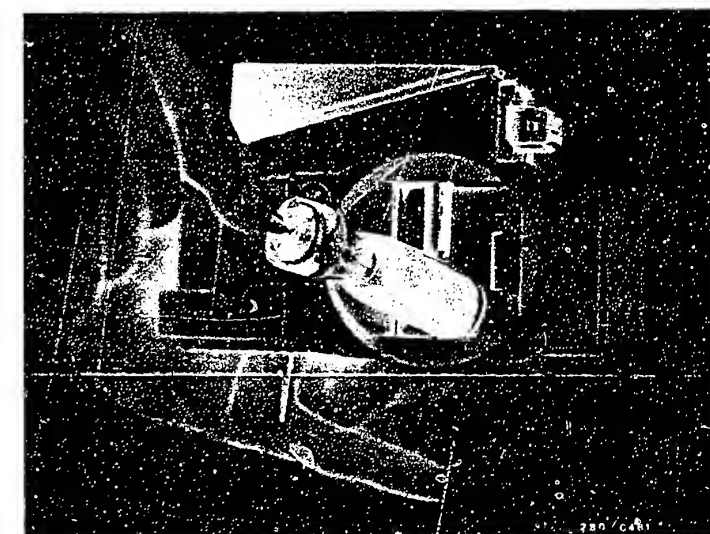
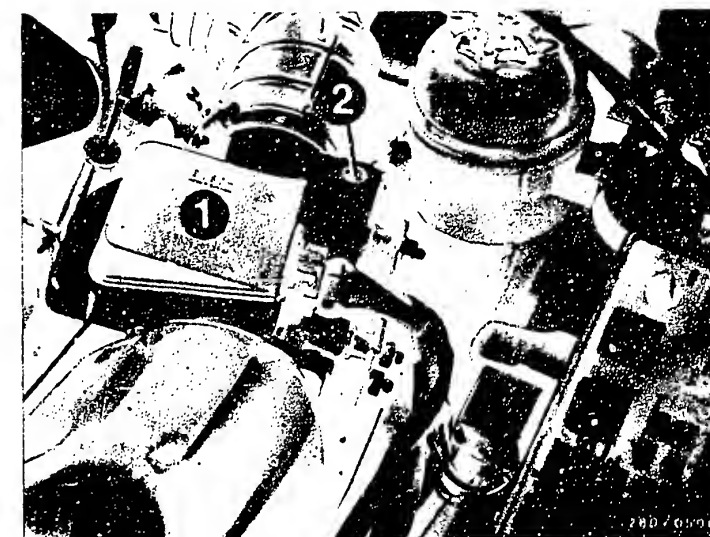
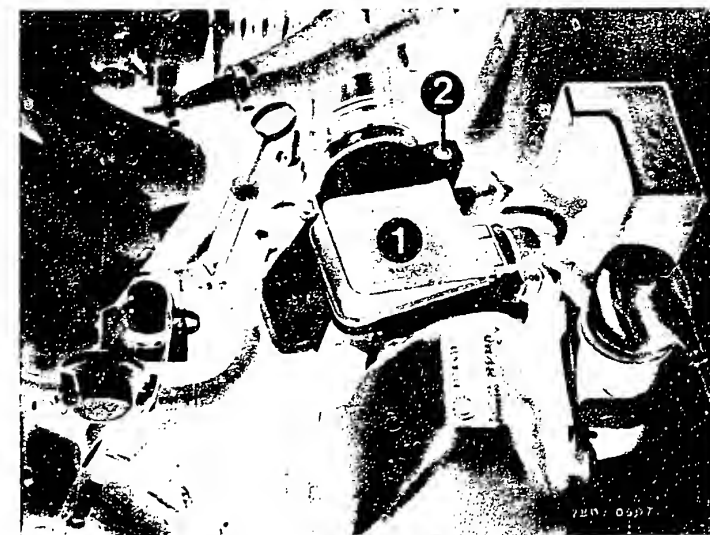
Middle illustration: 520i:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

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Test of potentiometer:
(Noise test)

* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motortester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

* Making the adapter lead:
two approx. 1 m long leads approx. 1.0 mm ² cross section and 10 A fuse. Secure at one end. At the other end, strip off approx. 2 cm of insulation and connect to the terminals of the special-input connecting lead.

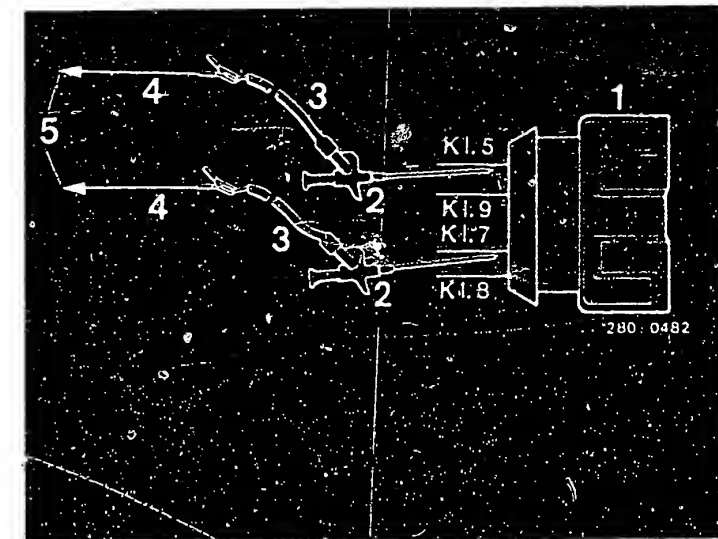
C A U T I O N !

Insulate bare connecting points of adapter lead (danger of short circuit). Carefully measure into the plug of the air-flow sensor. Do not bend any connecting springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

* Disconnect control relay. Connect jumper in connection base between term. 87 and term. 30. (Power supply from control unit).

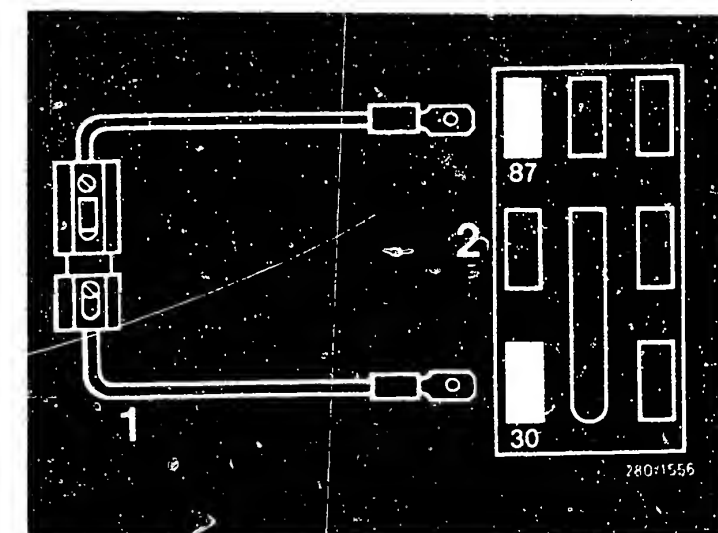
Continued on next picture page

Continued on next picture page



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (User-fabricated)
- 4 = Special input connecting lead
- 5 = Motortester special input

2 = Cable Bridge with 10 A fuse (User-fabricated)
2 = Top view of plug base (3/5-series models 9.84 similar)



↓

* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous signal must be visible on the oscilloscope.

If air-flow sensor defective, a noise signal appears, similar to the one shown opposite.
Replace air-flow sensor.

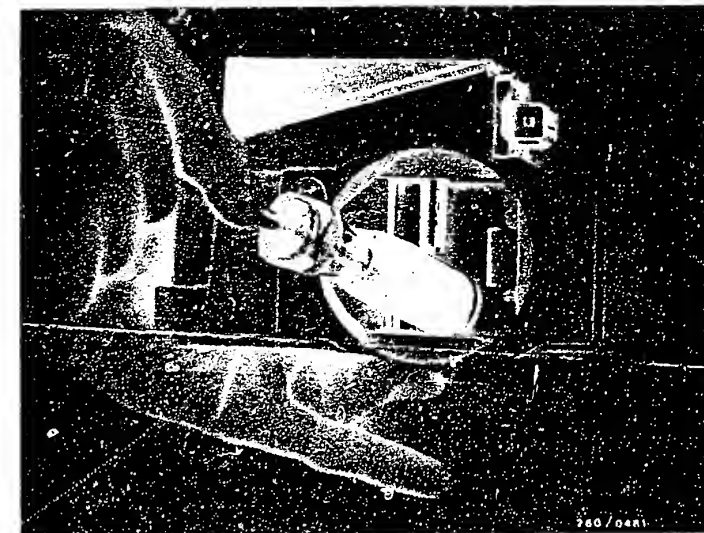
Disconnect adapter lead after testing and push on rubber sleeve properly.

Mount air-flow sensor.

Connect all hoses and tighten (no leaks).

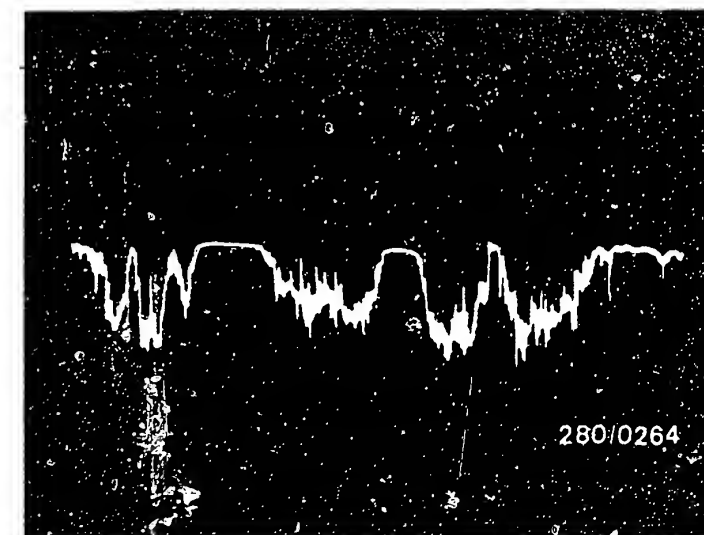
C A U T I O N !

After testing, remove jumper and connect control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



Continued on next picture page

Engine missing under all operating conditions (continued 6)

Is fuel delivery of electric fuel pump O.K.?

Test specification, min.:

2.0 l engine:
min. 700 cm³ /30 s

2.3 l engine:
min. 750 cm³ /30 s

Is test specification reached?

N>

* Measure fuel quantity:

- Loosen junction between fuel-return hose (from pressure regulator) and fuel-return line (to fuel tank) for testing.

- If necessary, lengthen hose and insert into a 5 l receptical with measuring scale.

- Disconnect control relay. Insert cable bridge between term. 87b and term. 30 in the plug base. Electric fuel pump must be running.

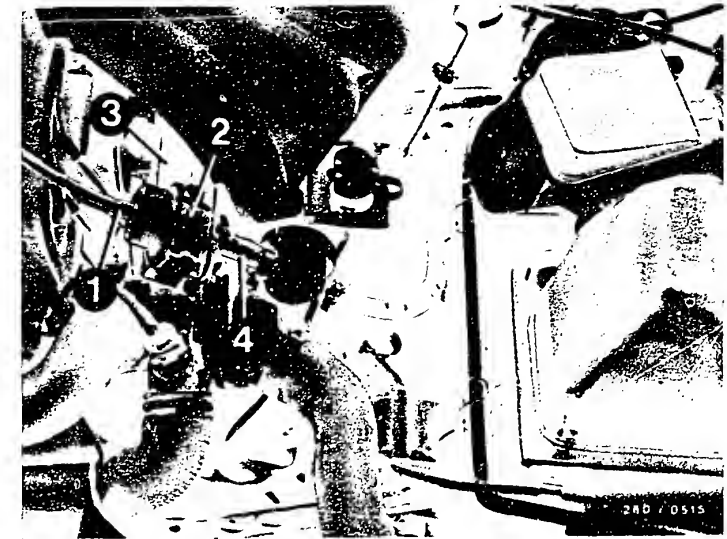
TEST SPECIFICATION:

2.0 l engine, min.
700 cm³ /30 s

2.3 l engine, min.
750 cm³ /30 s

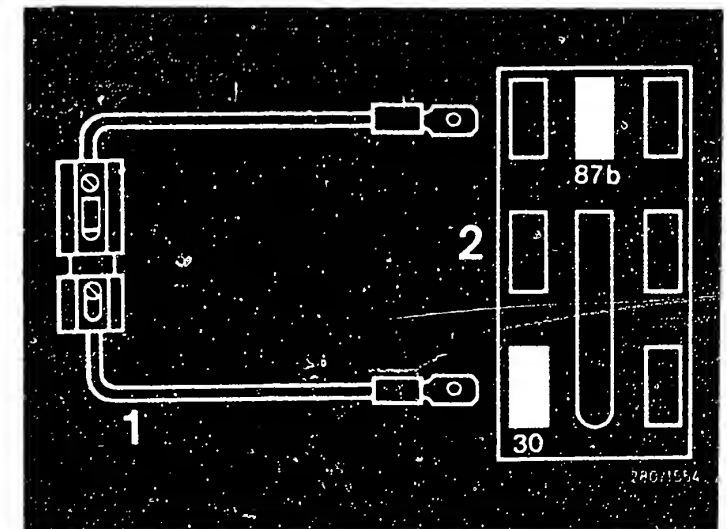
CAREFUL!

Cable bridge must be removed after testing has been completed.



- 1 = Intake manifold connection
- 2 = Pressure regulator
- 3 = Fuel-distribution pipe
- 4 = Fuel return line

- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
- 2 = Top view of connection base (3/5 series until 8.84 similar)

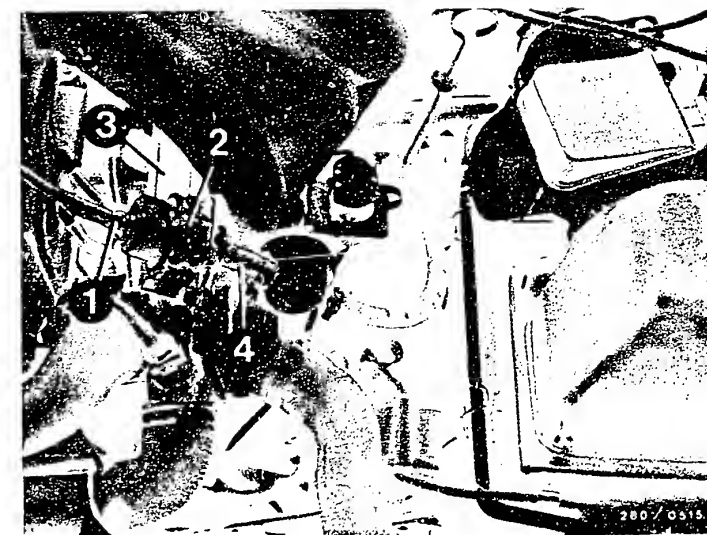


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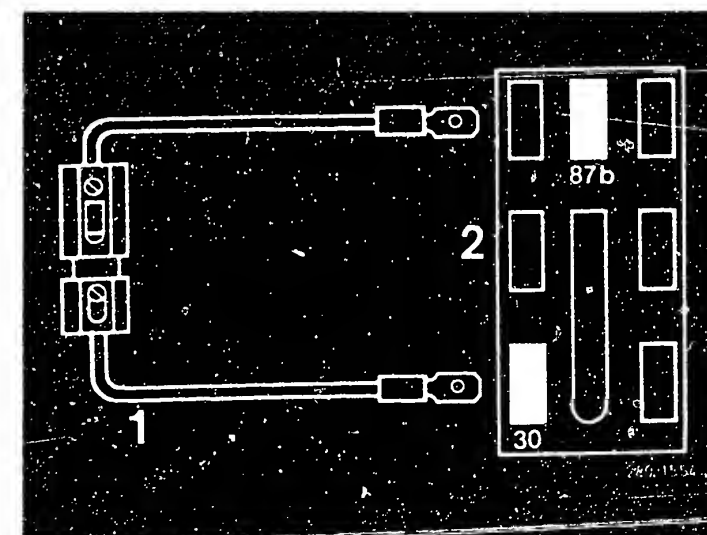
Remedial measure in case test specification not reached:

- * Fuel filter clogged → replace.
- * Voltage at fuel-pump plugs with engine running at least 12 V. If not, clean contacts, eliminate any poor ground connection, replace leads.
- * If pressure regulator defective → replace. The pressure regulator is fastened to the fuel-distribution pipe with two mounting screws and an O-ring. After removing the pressure regulator, the O-ring and the flat ring must be replaced (use parts set 1 287 010 704).
- * If fuel-pump delivery insufficient, replace electric fuel pump (on left underneath vehicle, near rear axle).



- 1 = Intake manifold connection
- 2 = Pressure regulator
- 3 = Fuel-distribution pipe
- 4 = Fuel return line

- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
- 2 = Top view of connection base (3/5 series until 8.84 similar)



Continued on next picture page

Engine missing under all operating conditions (continued 8)

Control unit O.K.?

- * Engine not missing?
- * Plug-in connections on control-unit plug O.K.?

N>

Let engine run.

- * Shake control unit lightly and move control-unit plug. Watch for engine missing.
- * Repair plug-in connection at control-unit plug or replace defective control unit.

Throttle valve closed?
Engine coughing on overrun?

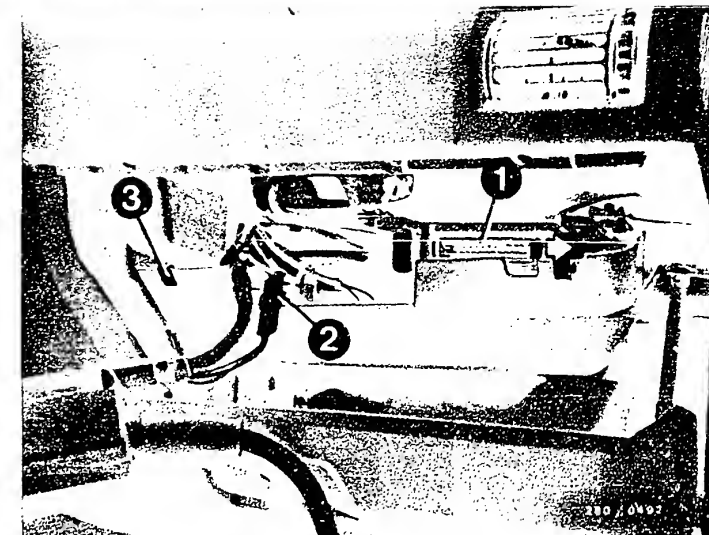
- * Does throttle lever come up against stop screw?
- * Throttle cable free of tension?
- * Throttle cable not kinked?

N>

* Check exhaust system for sealing.

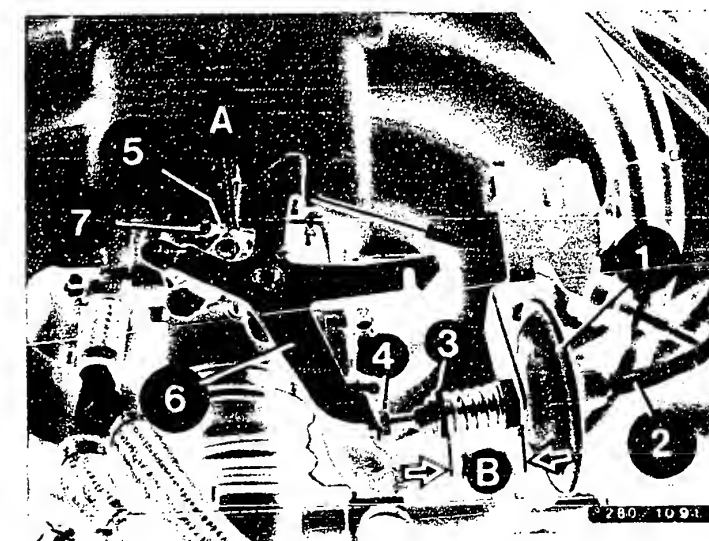
* Is throttle valve closed?

- * Test and if necessary correct basic setting of throttle valve.
 - Remove hose before throttle valve.
 - Pull off anti-tamper device (7) and unscrew throttle-valve stop screw (5) until the throttle-plate lever (6) no longer rests against the throttle-valve stop screw (5).
 - Place finger on throttle plate. Screw in throttle-valve stop screw (5) until the throttle plate begins to move.
 - Screw in throttle-valve stop screw (5) another 1/4 turn and replace anti-tamper device (7).
 - Secure throttle-valve stop screw with locking plate.



- 1 = Control unit
- 2 = Plug connection term. 1/t D
- 3 = Fastening screw for control-unit cover

- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 5 = Throttle-valve stop screw
- 6 = Throttle-plate lever
- 7 = Anti-tamper device



Continued on next picture page

Engine missing under all operating conditions (continued 9)

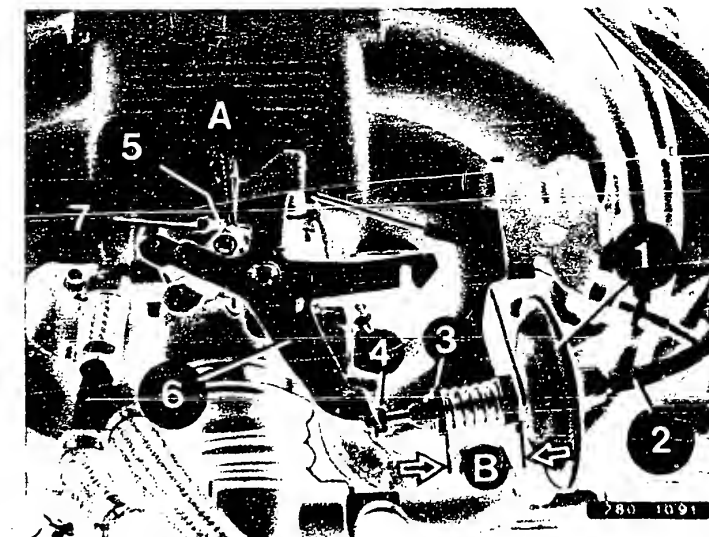
Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

N>

* Adjusting throttle-valve switch (beneath throttle-valve assembly): Apply vacuum to throttle-valve positioner with Mityvac pump until throttle-plate lever no longer rests against the throttle-valve positioner. Loosen the fastening screw of the throttle-valve switch somewhat. Connect ohmmeter at throttle-valve switch between term. 2 and lead 9 (term. 18). Turn throttle-valve switch to the right until the idle contact (microswitch) clicks audibly (reading 0 Ω).

* Adjustment check:
Pull accelerator cable slightly. The idle contact opens (micro-switch clicks audibly).
Reading: Infinite Ω .



- 1 = Throttle-valve positioner
- 2 = Vacuum hose
- 5 = Throttle-valve stop screw
- 6 = Throttle-plate lever
- 7 = Anti-tamper device

Continued on next picture page

Engine missing under all operating conditions (continued 10)

Engine coughing on overrun?
Overrun cutoff O.K.?

* Operation of control unit
O.K.?

* Reinstatement speed
O.K.?

cold: 2000 min⁻¹
warm: 1250 min⁻¹

N>

* Checking the operation of the overrun cutoff:

Connect test lead as follows:

The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one terminal need be connected to the special input of the motortester. If correctly connected, the pattern shown opposite is visible on the oscilloscope. Watch oscilloscope.

* Slowly raise engine speed to 3000 min⁻¹.

Injection pulses must be visible on the oscilloscope. Take foot off accelerator (idle position). No more injection pulses.

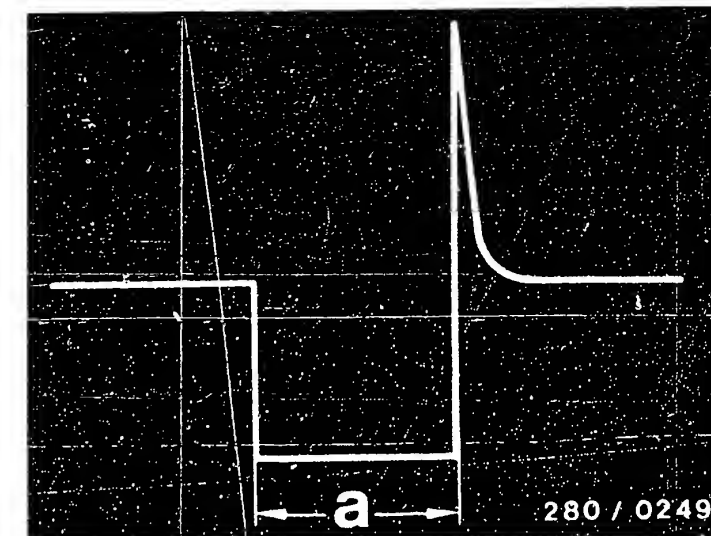
* Engine clearly below ambient temperature (+15° C...+30° C):

As of approx. 2000 min⁻¹ injection pulses must be visible again.

* Engine at operating temperature (approx. +80° C):

As of approx. 400 min⁻¹ injection pulses must be visible again.

If incorrect, replace control unit.



Injection pulses of a switched output stage (measured at the injection valve)

a = Pulse length (dependent on engine load)

Continued on next picture page

Engine missing under all operating conditions (continued 11)

Are CO and idle speed correctly set?

Test specification:

Idle speed:
750...850 min⁻¹

CO concentration

Europe:

less than 1.5 vol. % CO

Sweden/Switzerland version:

0.3 ... 0.6 vol. % CO.

Are specifications reached?

N>

Idle speed not adjustable.

Continued on next picture page

CO and idle setting

Europe version:

Exhaust setting using exhaust tester
with engine idling at operating
temperature.

* Idle speed:

Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹.

* CO setting:

Lower than 1.5 vol.% CO

Sweden/Switzerland version:

These vehicles are equipped with
secondary-air induction.

Test specification:

CO setting at 800 ... 900 min⁻¹ ;
0.3 ... 0.6 vol.% CO (with hose
connected to air valves).

* Setting value in case of defect:

Idle speed: 750 ... 850 min⁻¹

CO setting:

0.8 ... 1.3 vol.% CO

with air-valve hose pulled and
sealed.

Continued on next picture page



1 = CO-adjusting screw

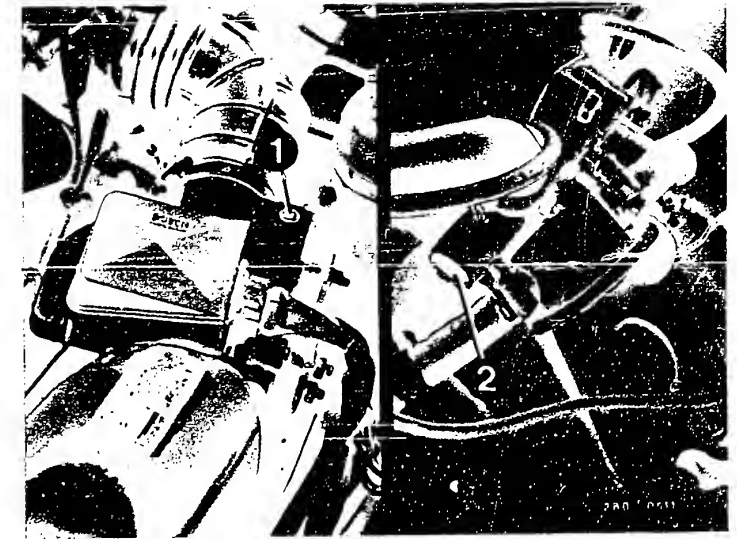
2 = Idle-speed adjusting screw

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug. Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

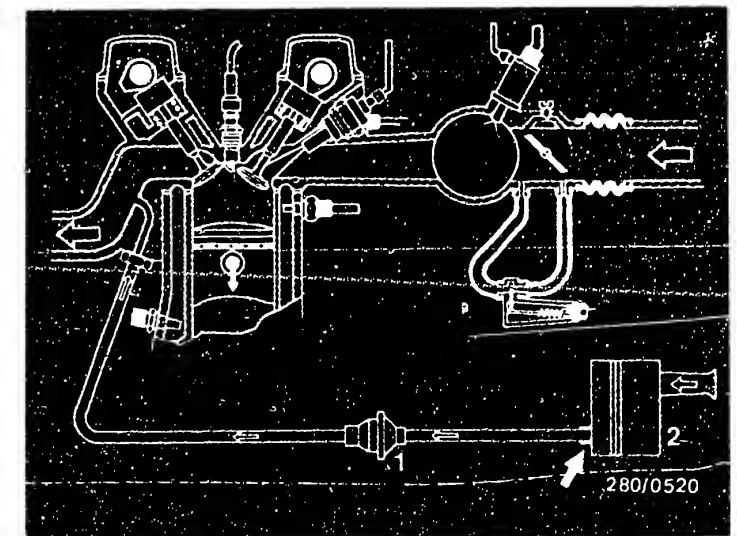
If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).

Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



Continued on next picture page

Engine missing under all operating conditions (continued 13)

Is there a sharp re-engagement
jolt with overrun cut-off?

Is 3/2-way valve O.K.?

N>

* Trouble-shooting

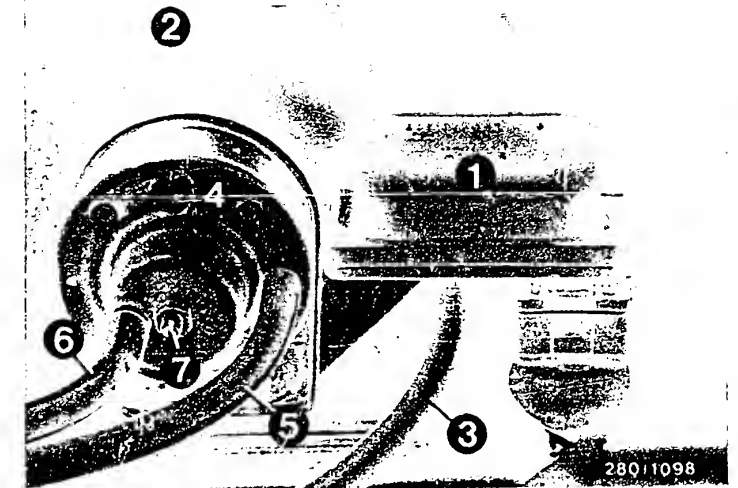
- Render overrun cut-off non-functional.
- Pull plug from throttle-valve switch.
Does vehicle continue to buck?
If so, check drive train.
If not, check 3/2-way valve and adjust if necessary.

* Testing 3/2-way valve:

Insert T-piece (user-fabricated) into the vacuum line between the 3/2-way valve and the ignition distributor and connect to vacuum tester (result can be read in vehicle interior).

- Move vehicle in overrun.
With throttle valve open:
Reading 0 bar

With throttle valve closed:
Reading 0.6 bar (negative gauge pressure).



- 4 = 3/2-way valve
- 5 = To vacuum unit at ignition distributor
- 6 = To throttle-valve assembly
- 7 = Adjustment screw

Continued on next picture page

Continued on next picture page

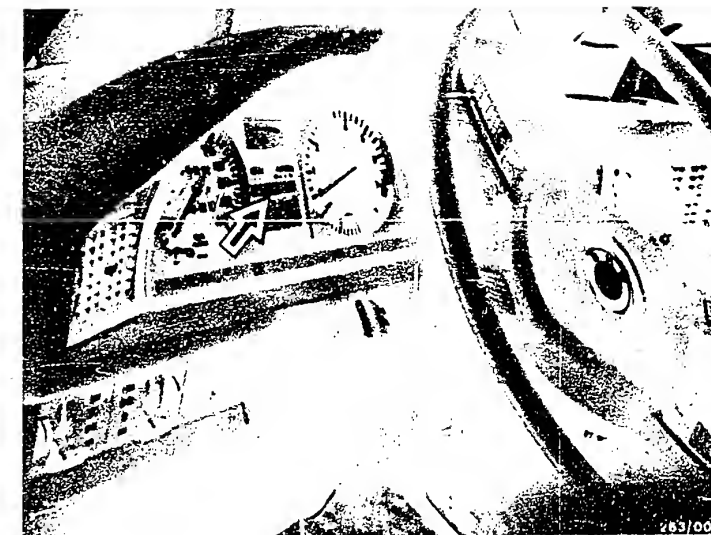
V

* Adjusting 3/2-way valve:

- Set up vacuum tester in vehicle interior.
- During overrun, observe fuel-consumption meter and vacuum tester.

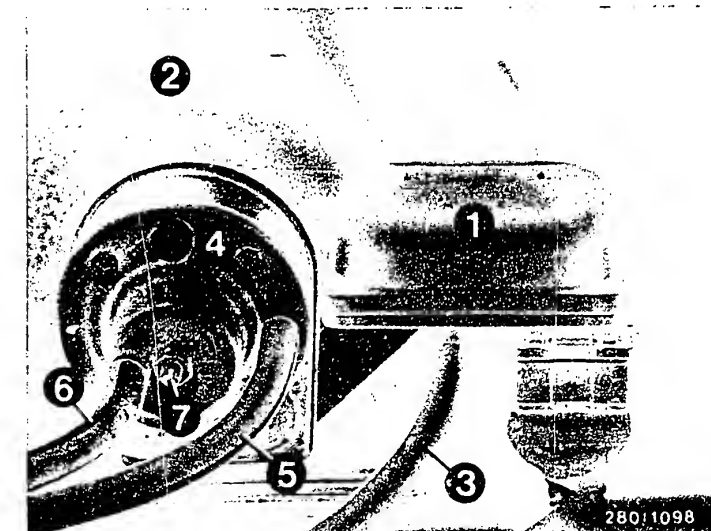
When 3/2-way valve is correctly set, the vacuum should fall when the fuel is again injected.
(Since the vacuum drop is displayed at the vacuum tester with some delay due to the additional volume drop in the test line, the setting should show somewhat earlier fuel injection.)

- Adjustment
Adjust in small steps (1/2 turns) with adjustment screw.



Arrow = Fuel-consumption display

- 1 = Pressure switch
- 2 = Air-filter cover
- 3 = Vacuum hose
- 4 = 3/2-way valve
- 5 = To vacuum unit at ignition distributor
- 6 = To throttle-valve assembly
- 7 = Adjustment screw



V

Continued on next picture page

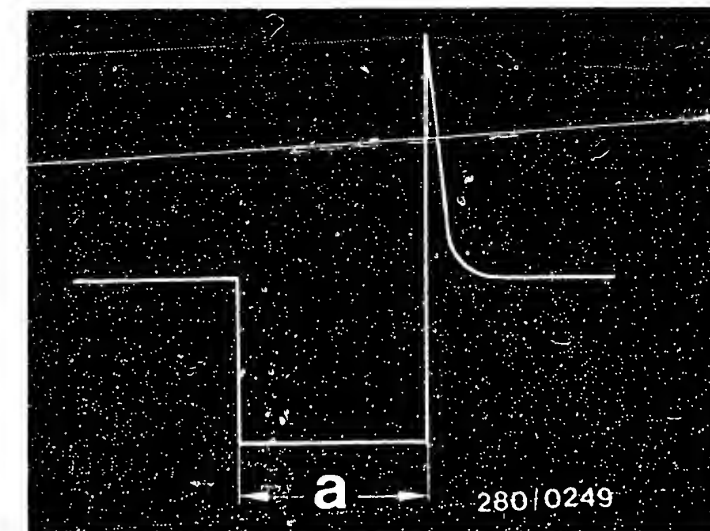
Engine missing under all operating conditions (continued 15)

Injection valves checked for correct operation?

- * Injection pulse without interference or missing?
- * Leads correctly routed?
- * No loose contacts in plug-in connections?

N>

- * Connect test cable: Connect two-pin plug connector between a solenoid-operated injection valve and its connecting lead. Of the two other connection terminals only one terminal should be connected to a motortester (special input). The other terminal must not come into contact with ground. With correct connection and the engine running, the injection pulse will look like the upper illustration. If the injection-pulse pattern is not obtained or if interference, engine misfiring, etc can be seen, the other injection valves should be tested as well.
- * In case of interference -> check cable routing.
- * In case of misfires -> eliminate loose contacts in leads or plug connections.



Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

Continued on next picture page

Are solenoid-operated injection valves in good mechanical and hydraulic order?

N>

* Carry out mechanical and hydraulic check of solenoid-operated injection valves:
Let engine run at operating temperature (+80°C). Pull solenoid-operated injection valve plugs individually from the injection valves one after the other and reconnect. Engine speed should:
1. remain almost constant in case of a defective injection valve.
2. sink considerably if the injection valve is good.
Wait until you get a constant engine speed.
Replace any defective solenoid-operated injection valves.

Are solenoid-injection valves in good electrical order?

N>

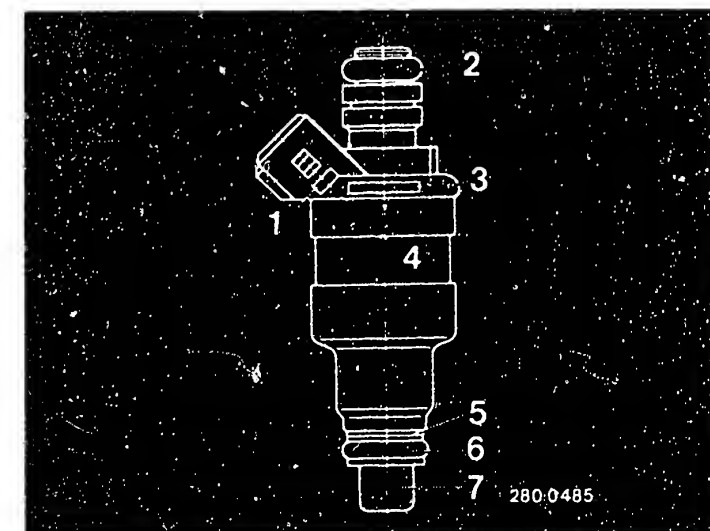
* Carry out electrical test of solenoid-operated injection valves:
Test connecting cable from control relay term. 87 to the individual injection valves and from the injection valves to the control-unit plug term. 12 / term. 27 for continuity using ohmmeter.
Nominal value approx. 0 Ω

Resistance of the individual solenoid-operated injection valves:

0 280 150 208/210:
15 ... 20 Ω
0 280 150 705/716:
14.5...19.5 Ω

Arrows = Injection valves

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

Engine missing under all operating conditions (continued 17)

Repair solenoid-operated injection valves.
O-ring O.K.?

N>

NOTE !

* Replace O-ring:
If solenoid-operated injection valve is changed, the same injection valve must be installed.

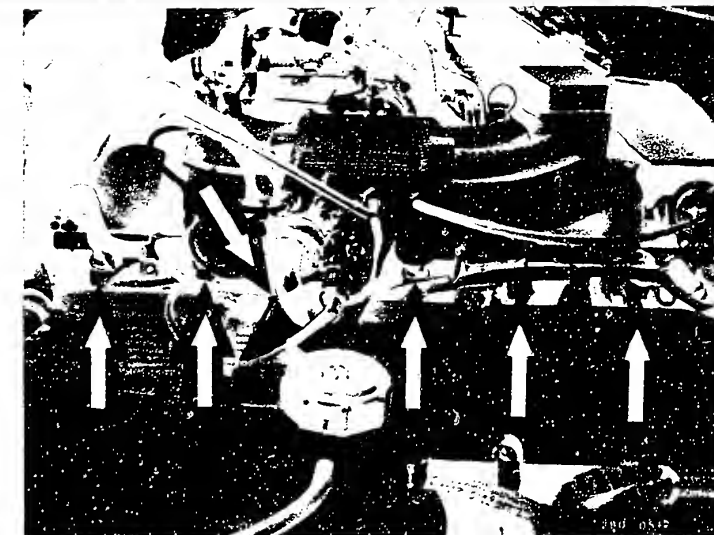
If the injection valves are in good order but the O-rings are defective, proceed as follows:

1. Repair instructions for solenoid-operated injection valve ... 208 as of FD 252 and 210/705 and 716:

Remove fuel-distribution pipe (loosen 2 fastening screws). Disconnect electrical connection. Carefully push the retaining clamp out of the groove and pull the injection valve out of the fuel-distribution pipe.

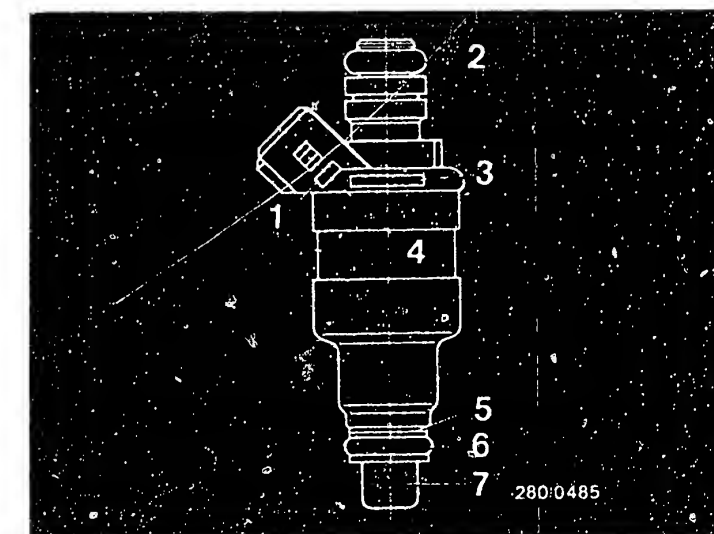
CAREFUL !

Catch escaping fuel. Do not allow to drip onto hot engine parts (fire hazard!). Protection sleeves must not be pried off.



Arrows = Injection valves

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

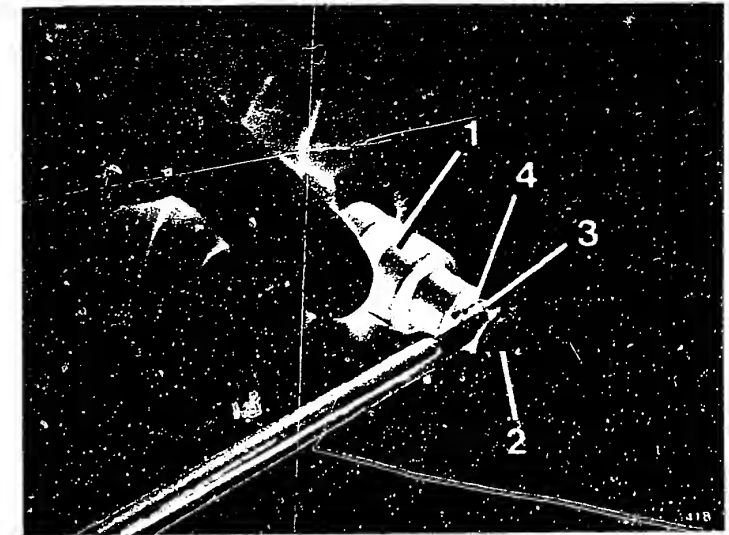
Continued on next picture page

Cut up lower O-ring (intake manifold).

Careful!
Do not damage protection sleeve.
Pull a new O-ring over the protection sleeve and its shoulder.
Be careful not to damage any parts.

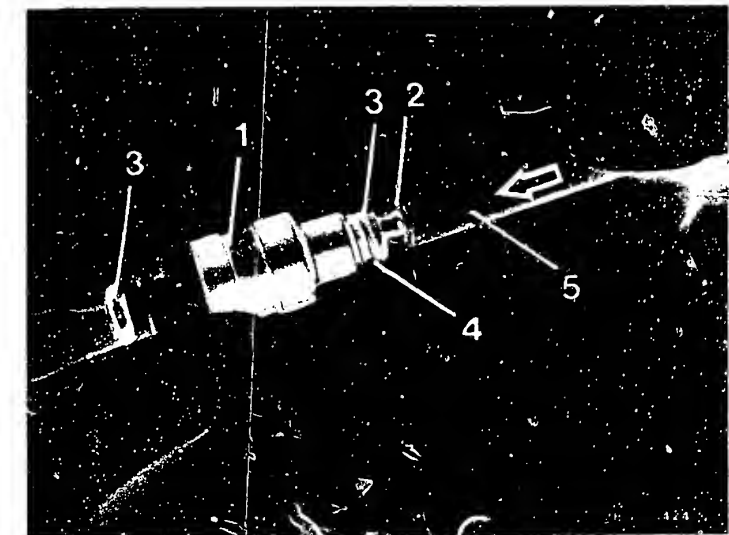
Use parts set 1 287 010 704.

When working on the solenoid-operated injection valves do not damage the valve needles. If the upper O-ring (on fuel-distribution pipe connection) is swollen or damaged it must be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

- 1 = Solenoid-operated injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe connection



Continued on next picture page

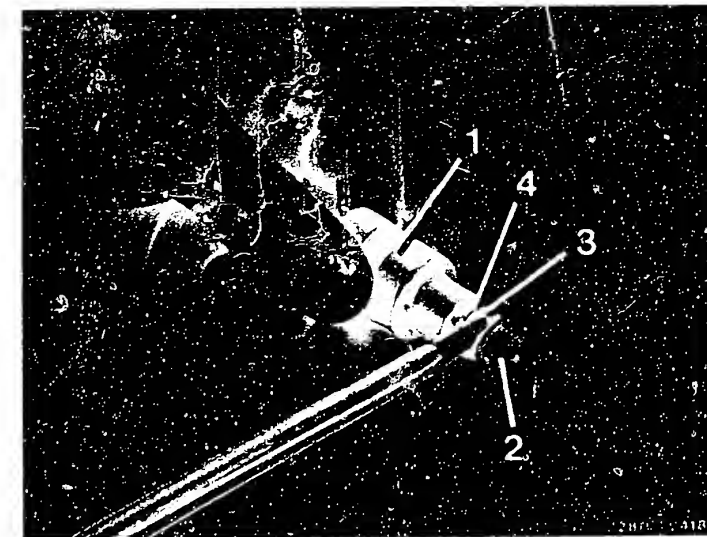
Continued on next picture page

2. Repair instructions only for solenoid-operated injection valve
.. 208 to FD (date of manufacture)
251: Replace protection sleeve or O-ring. Remove fuel-distribution pipe. Pull electrical connection. Carefully push retaining clip out of groove and pull injection valve out of fuel-distribution pipe.

C a r e f u l !

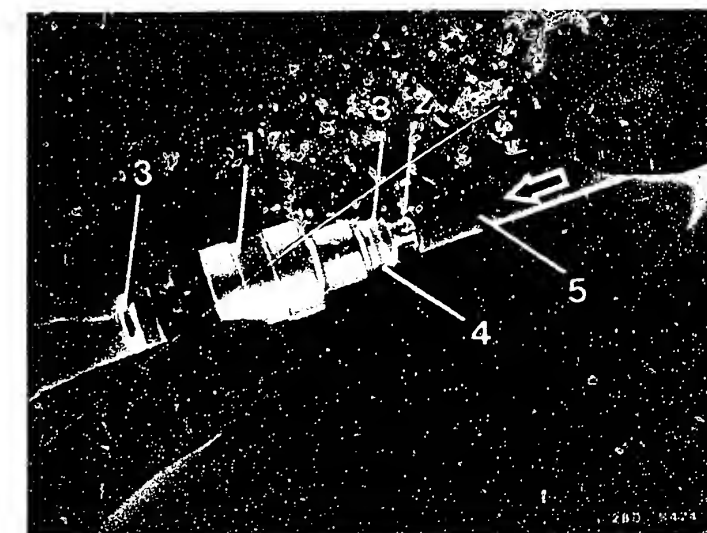
Catch any fuel running out. Do not allow fuel to drop onto hot engine parts. Carefully pry off protection sleeve.

Careful! Do not damage protruding injection-valve needles. Pry off lower O-ring (3). Use parts set 1 287 010 704. Pull on lower O-ring (3) and carefully push on a new protection sleeve with user-fabricated pipe section (approx. 120 mm long with inside diameter of 10 mm). Do not damage injection-valve needles. If the O-ring (fuel-distribution-pipe connection) is swollen, it must also be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

- 1 = Solenoid-operated injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe connection



Continued on next picture page

Continued on next picture page

Engine missing under all operating conditions (continued 20)

V

General:

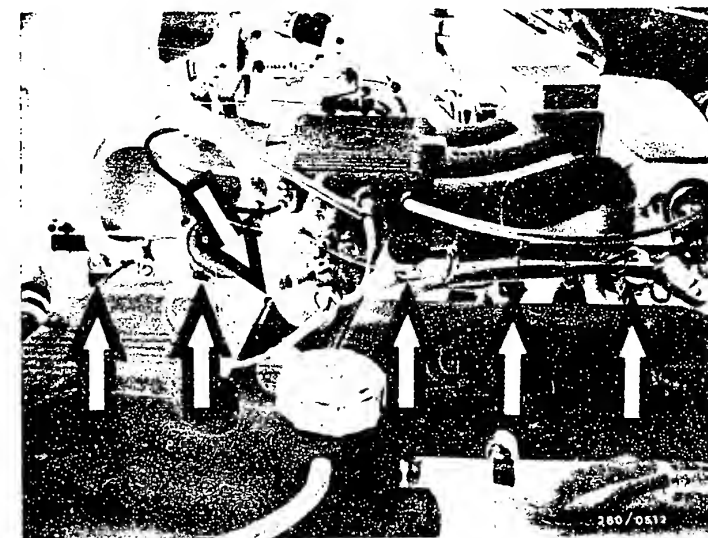
Careful!

The two O-rings must be only lightly lubricated prior to installation with clean engine oil, e.g. HD30.

The remaining solenoid-operated injection valve parts must remain oil-free.

Careful!

After testing, restore to original installed condition.



Arrows = Injection valves

V

Continued on next picture page

K03

<=>

K04

<=>

Is there an absence of bucking during acceleration with engine at operating temperature?

N>

Is pressure switch for part-load enrichment O.K.?

3231	as of 2.83	until 8.84
3201	as of 3.83	until 8.84
5201	as of 9.83	until 8.84

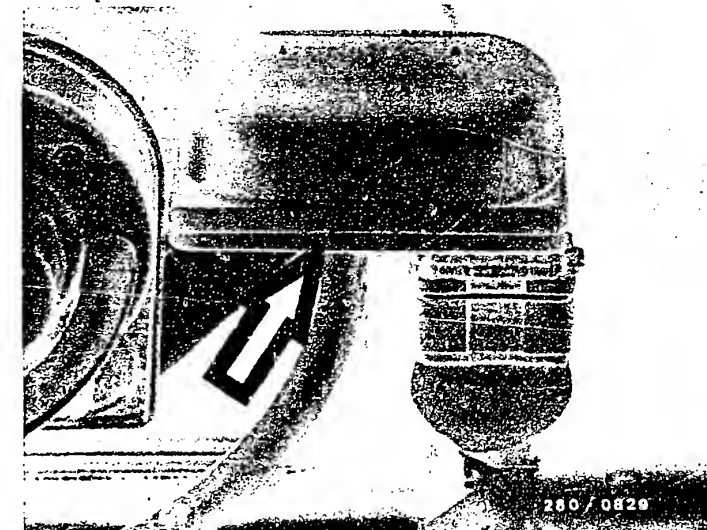
Testing:

- Connect exhaust-gas analyzer.
- Allow engine to run at operating temperature.
- Pull hose at pressure switch and seal.
- CO concentration should arise (approx. 2.5 vol.% CO).

Testing O.K.?

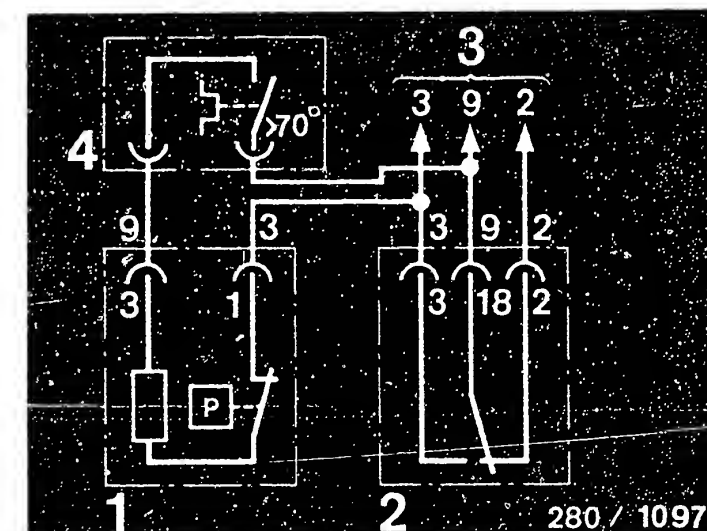
Continue trouble-shooting. If not, test electrical connection leads for continuity (nominal resistance approx. 0 Ω):

- From throttle-valve switch to pressure switch term. no. 1
- From throttle-valve switch term. 18, lead 9 to thermo-switch 70°C and further to pressure switch term. no. 3.
- Resistance at pressure switch between terms. 3 and 1 approx. 30 k Ω .
- Test vacuum hose for sealing.



Arrow = Pressure switch

- 1 = Pressure switch
- 2 = Throttle-valve switch
- 3 = To control-unit plug terms. 3/9/2
- 4 = Thermo-switch 70°C



Continued on next picture page

Engine missing under all operating conditions (continued 22)

V
Are CO concentration and idle speed correctly set?
(Repeat)

N>
Test specification:
Idle speed:
750...850 min⁻¹

CO concentration
Europe:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
0.3...0.6 vol.% CO

Are test specifications reached?

Y
V
Idle speed not adjustable.

V
Continued on next picture page

CO and idle setting

Europe version:
Exhaust setting using exhaust tester with engine idling at operating temperature.

* Idle speed:
Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹

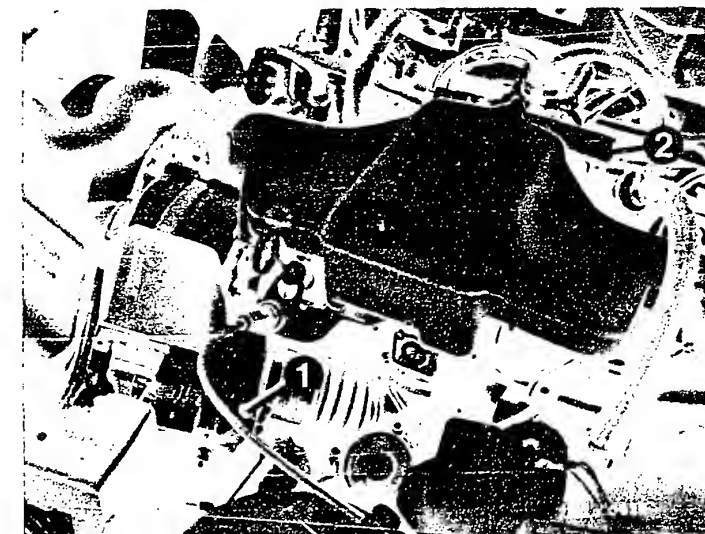
* CO setting:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
These vehicles are equipped with secondary-air induction.

Test specification:
CO setting at 800 ... 900 min⁻¹ :
0.3 ... 0.6 vol.% CO (with hose connected to air valves).

* Setting value in case of defect:
Idle speed: 750 ... 850 min⁻¹
CO setting:
0.8 ... 1.3 vol.% CO
with air-valve hose pulled and sealed.

V
Continued on next picture page



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

Trouble-shooting program for customer complaint

"engine missing under all operating conditions"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

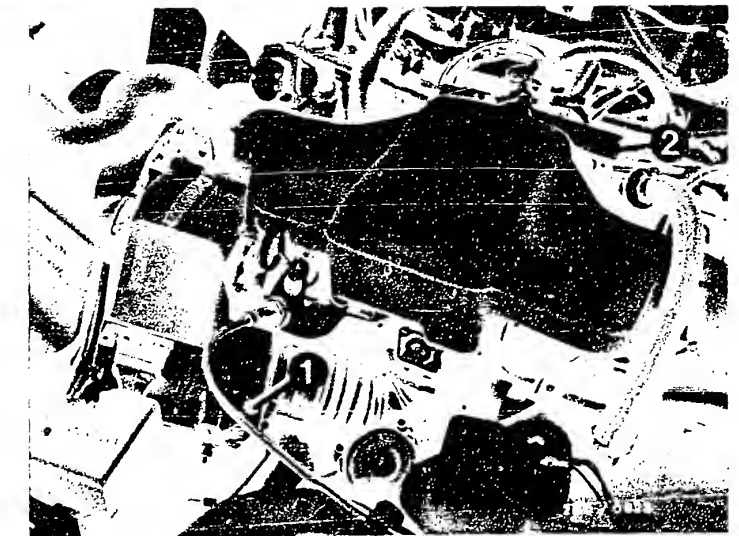
Detailed trouble-shooting chart coordinates C03/C04..
Direct trouble-shooting chart coordinates C05...C08..

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug.
Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

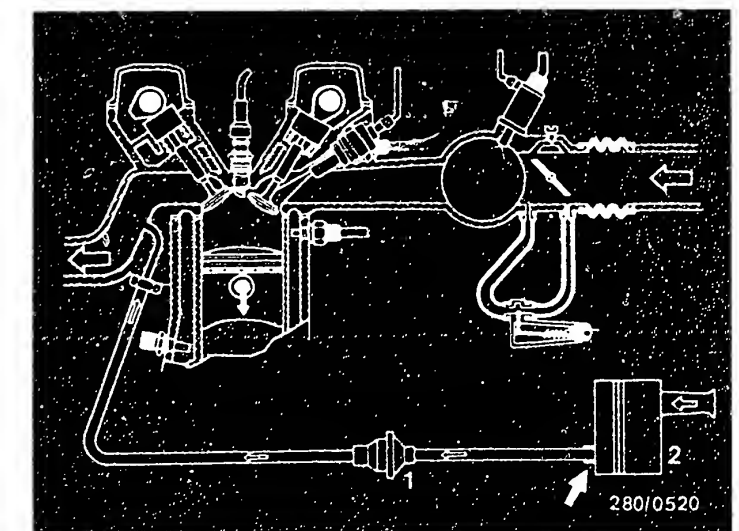
If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).

Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve (non-return valve)
2 = Air filter



Trouble-shooting program according to customer complaints

Procedure

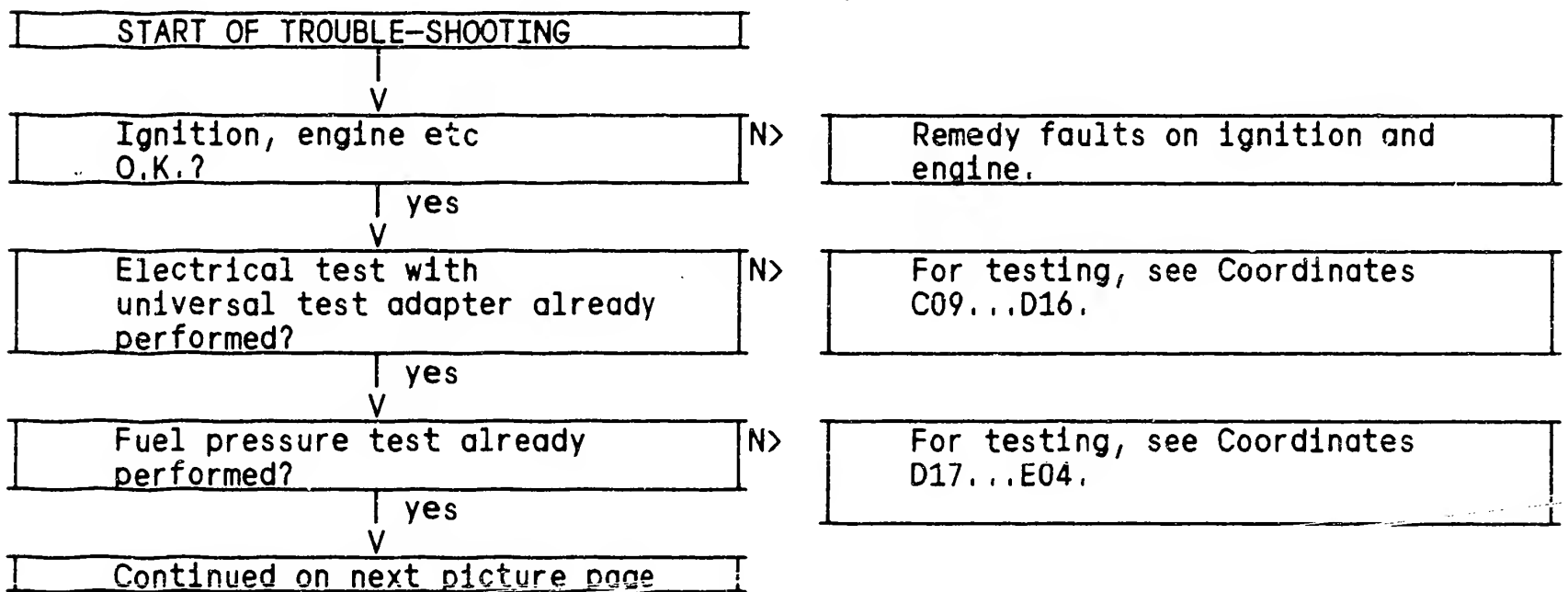
The test is divided into 3 rows of boxes:

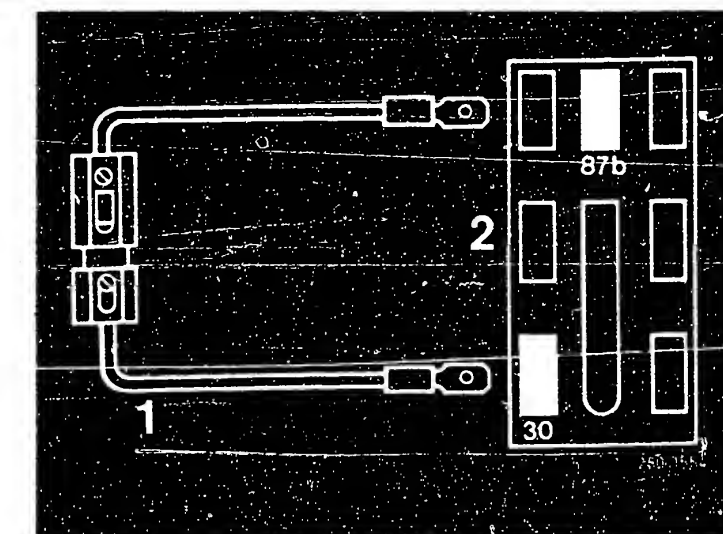
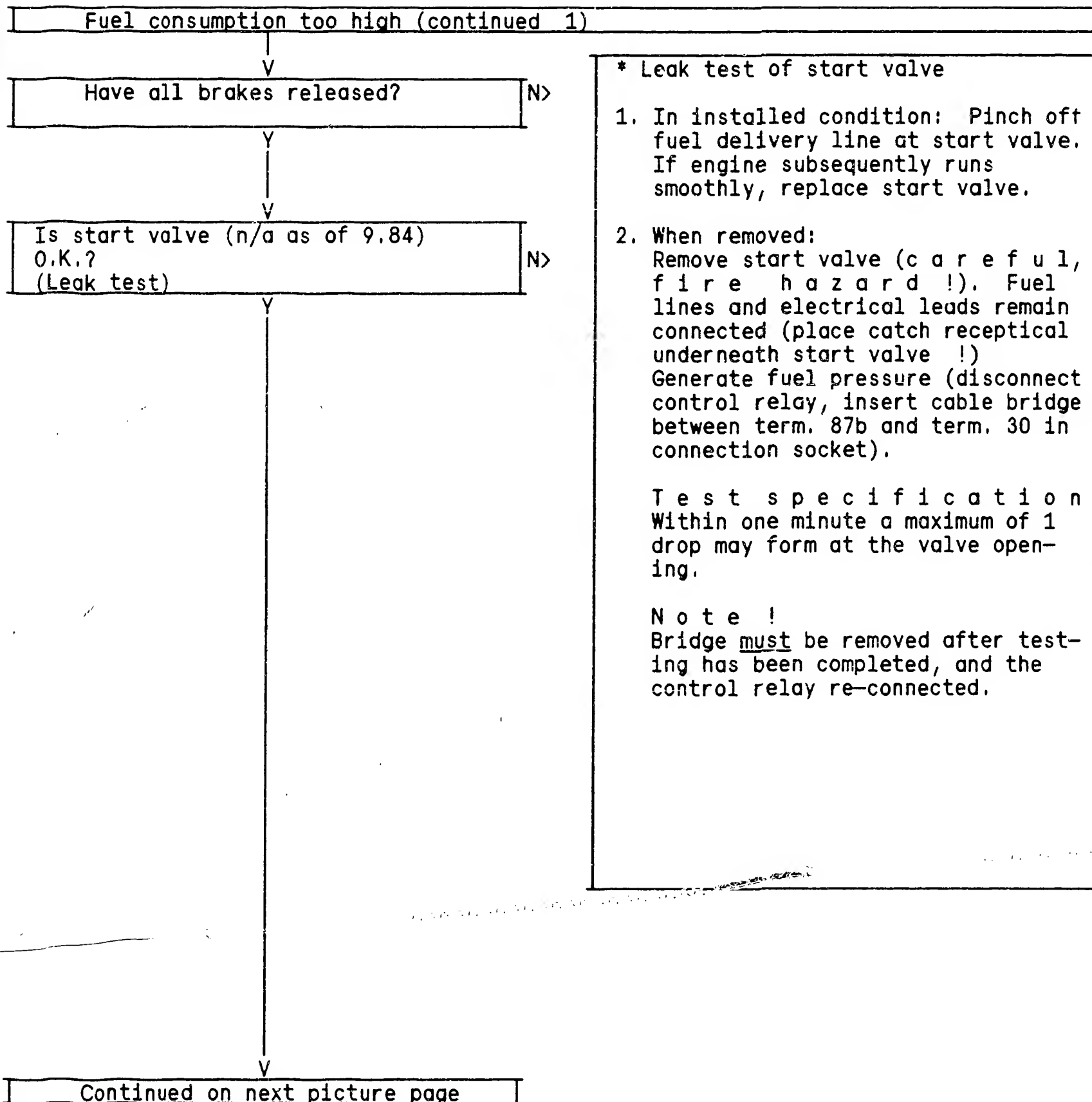
- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

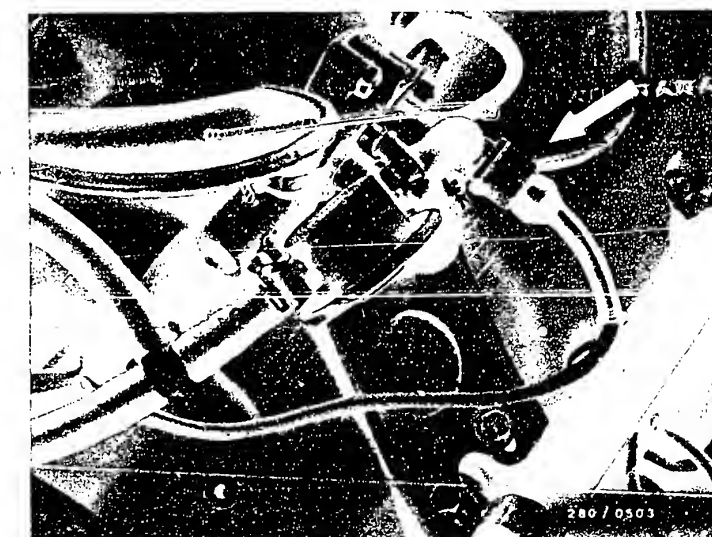
After testing, continue trouble-shooting at the point at which you branched off.





1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
 2 = Top view of connection base (3/5 series until 8.84 similar)

Arrow = Solenoid-operated cold-start valve (blue plug)



Is there an absence of bucking during acceleration with engine at operating temperature?

N>

Is pressure switch for part-load enrichment O.K.?

3231	as of 2.83	until 8.84
3201	as of 3.83	until 8.84
5201	as of 9.83	until 8.84

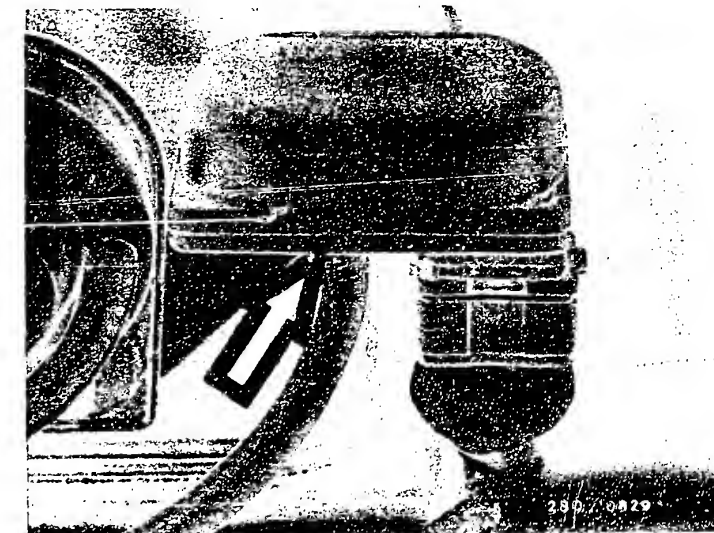
Testing:

- Connect exhaust-gas analyzer.
- Allow engine to run at operating temperature.
- Pull hose at pressure switch and seal.
- CO concentration should arise (approx. 2.5 vol.% CO).

Testing O.K.?

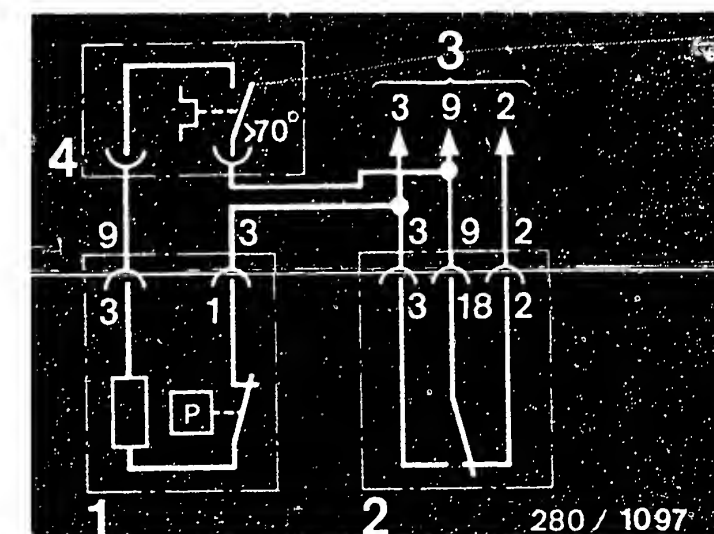
Continue trouble-shooting. If not, test electrical connection leads for continuity (nominal resistance approx. 0 Ω):

- From throttle-valve switch to pressure switch term. no. 1
- From throttle-valve switch term. 18, lead 9 to thermo-switch 70°C and further to pressure switch term. no. 3.
- Resistance at pressure switch between terms. 3 and 1 approx. 30 k Ω .
- Test vacuum hose for sealing.



Arrow = Pressure switch

- 1 = Pressure switch
- 2 = Throttle-valve switch
- 3 = To control-unit plug terms. 3/9/2
- 4 = Thermo-switch 70°C



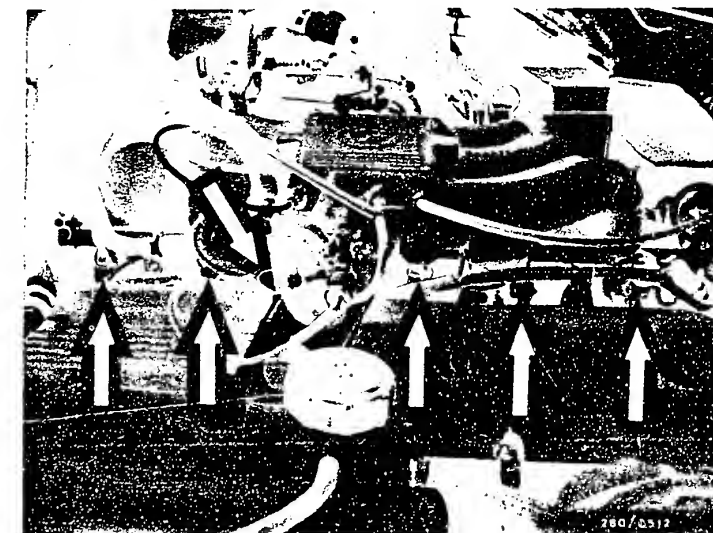
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Fuel consumption too high (continued 3)

Are solenoid-operated injection valves in good mechanical and hydraulic order?

N>

* Carry out mechanical and hydraulic check of solenoid-operated injection valves:
Let engine run at operating temperature (+80°C). Pull solenoid-operated injection valve plugs individually from the injection valves one after the other and reconnect. Engine speed should:
1. remain almost constant in case of a defective injection valve.
2. sink considerably if the injection valve is good.
Wait until you get a constant engine speed.
Replace any defective solenoid-operated injection valves.



Arrows = Injection valves

Are solenoid-injection valves in good electrical order?

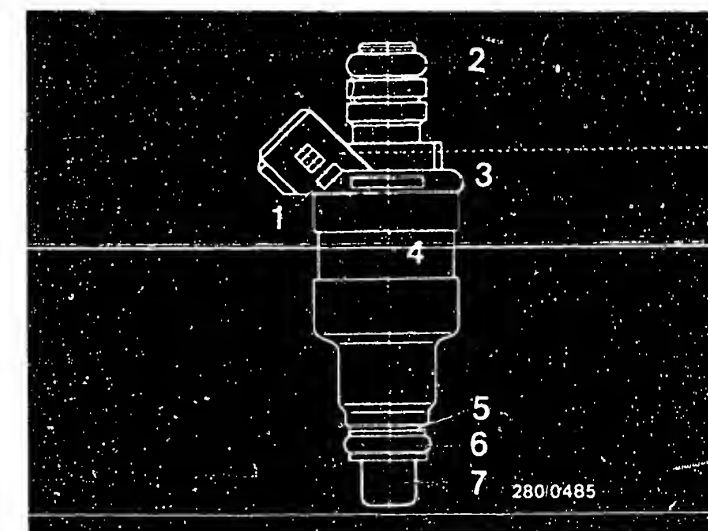
N>

* Carry out electrical test of solenoid-operated injection valves:
Test connecting cable from control relay term. 87 to the individual injection valves and from the injection valves to the control-unit plug term. 12 / term. 27 for continuity using ohmmeter.
Nominal value approx. 0 Ω

Resistance of the individual solenoid-operated injection valves:

0 280 150 208/210:
15 ... 20 Ω
0 280 150 705/716:
14.5...19.5 Ω

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

Repair solenoid-operated injection valves.
O-ring O.K.?

N>

NOTE !

* Replace O-ring:
If solenoid-operated injection valve is changed, the same injection valve must be installed.

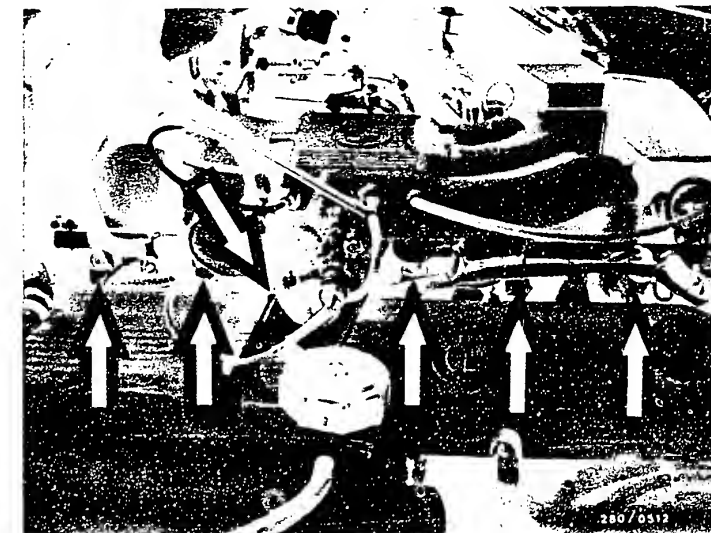
If the injection valves are in good order but the O-rings are defective, proceed as follows:

1. Repair instructions for solenoid-operated injection valve ... 208 as of FD 252 and 210/705 and 716:

Remove fuel-distribution pipe (loosen 2 fastening screws). Disconnect electrical connection. Carefully push the retaining clamp out of the groove and pull the injection valve out of the fuel-distribution pipe.

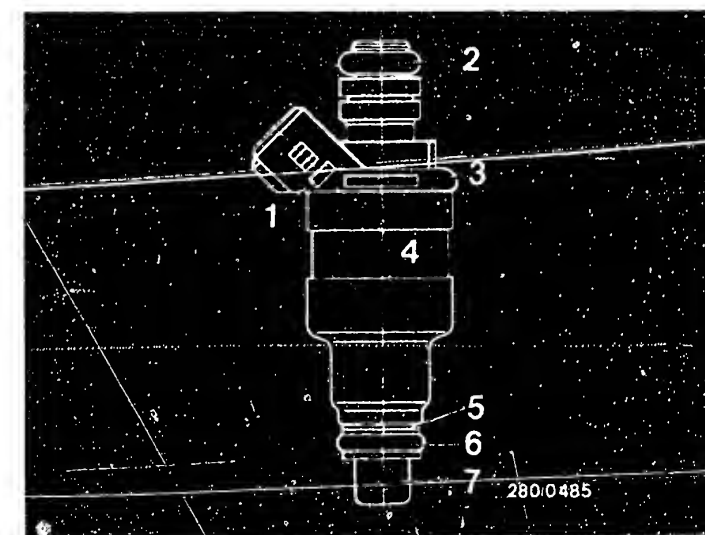
CAREFUL !

Catch escaping fuel. Do not allow to drip onto hot engine parts (fire hazard!). Protection sleeves must not be pried off.



Arrows = Injection valves

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



Continued on next picture page

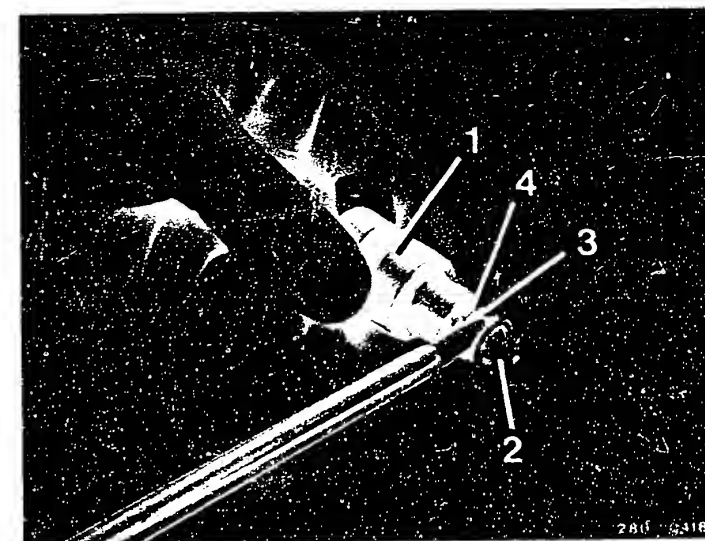
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Cut up lower O-ring (intake manifold).

Careful!
Do not damage protection sleeve.
Pull a new O-ring over the protection sleeve and its shoulder.
Be careful not to damage any parts.

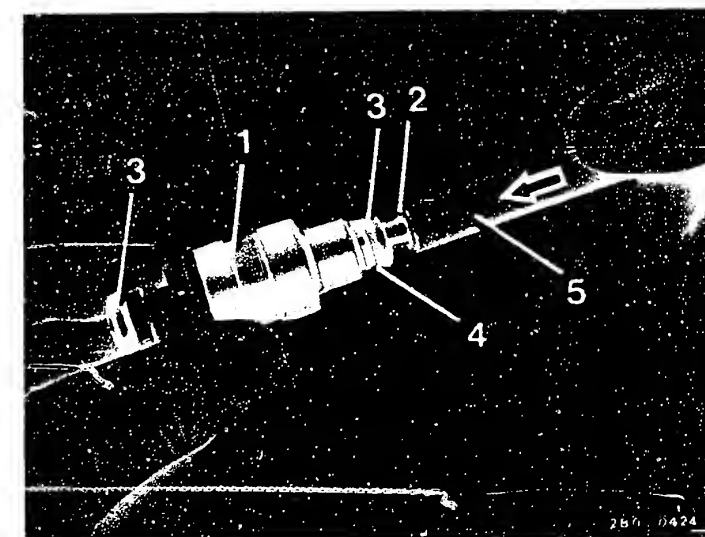
Use parts set 1 287 010 704.

When working on the solenoid-operated injection valves do not damage the valve needles. If the upper O-ring (on fuel-distribution pipe connection) is swollen or damaged it must be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

- 1 = Solenoid-operated injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe connection



Continued on next picture page

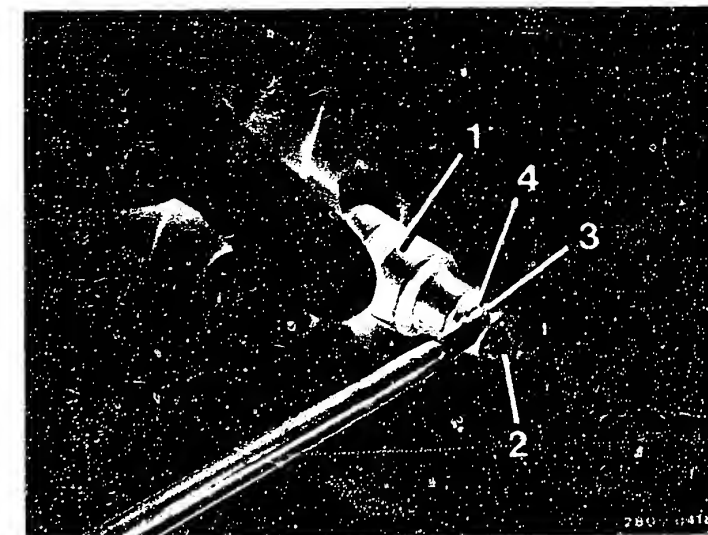
Continued on next picture page

2. Repair instructions only for solenoid-operated injection valve .. 208 to FD (date of manufacture) 251: Replace protection sleeve or O-ring. Remove fuel-distribution pipe. Pull electrical connection. Carefully push retaining clip out of groove and pull injection valve out of fuel-distribution pipe.

C a r e f u l !

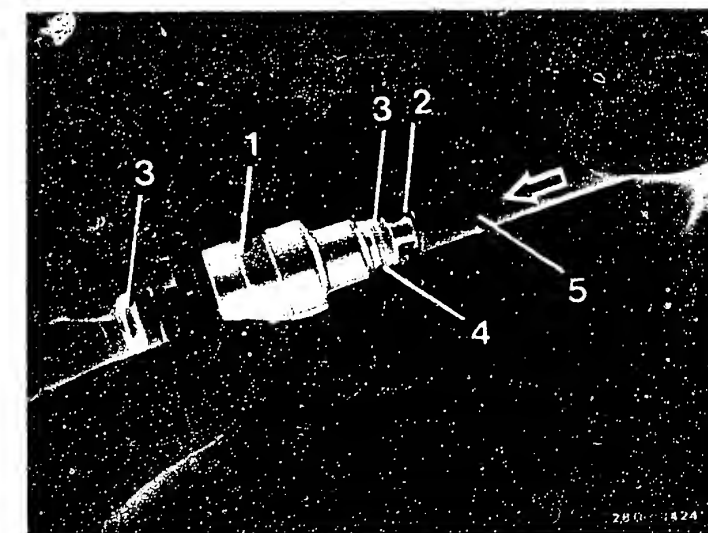
Catch any fuel running out. Do not allow fuel to drop onto hot engine parts. Carefully pry off protection sleeve.

Careful! Do not damage protruding injection-valve needles. Pry off lower O-ring (3). Use parts set 1 287 010 704. Pull on lower O-ring (3) and carefully push on a new protection sleeve with user-fabricated pipe section (approx. 120 mm long with inside diameter of 10 mm). Do not damage injection-valve needles. If the O-ring (fuel-distribution-pipe connection) is swollen, it must also be replaced.



- 1 = Solenoid-operated injection valve
- 2 = Protection sleeve
- 3 = Lower O-ring
- 4 = Supporting plate

- 1 = Solenoid-operated injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe connection



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Continued on next picture page



General:

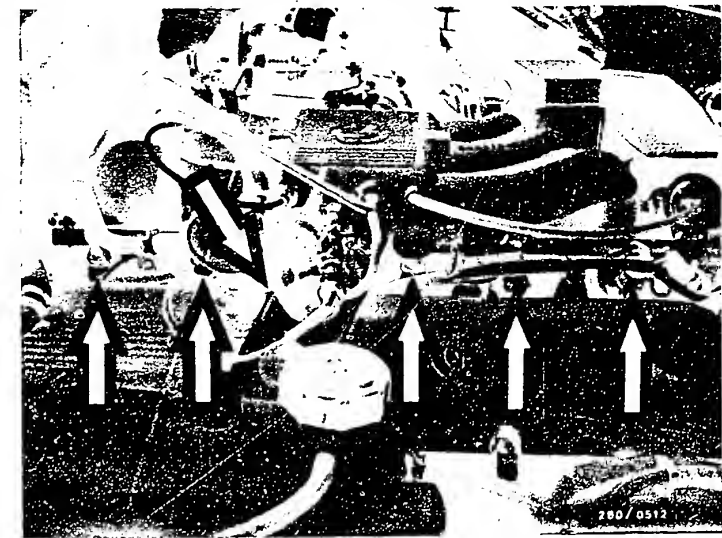
Careful!

The two O-rings must be only lightly lubricated prior to installation with clean engine oil, e.g. HD30.

The remaining solenoid-operated injection valve parts must remain oil-free.

Careful!

After testing, restore to original installed condition.



Arrows = Injection valves



Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

Testing:

Loosen clamp fasteners on air filter, lift off air filter upper section.

- * Test sensor flap for freedom of motion:

Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.

- * Mechanical test of air-flow sensor:

Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

Upper illustration: 320i/ 323i:

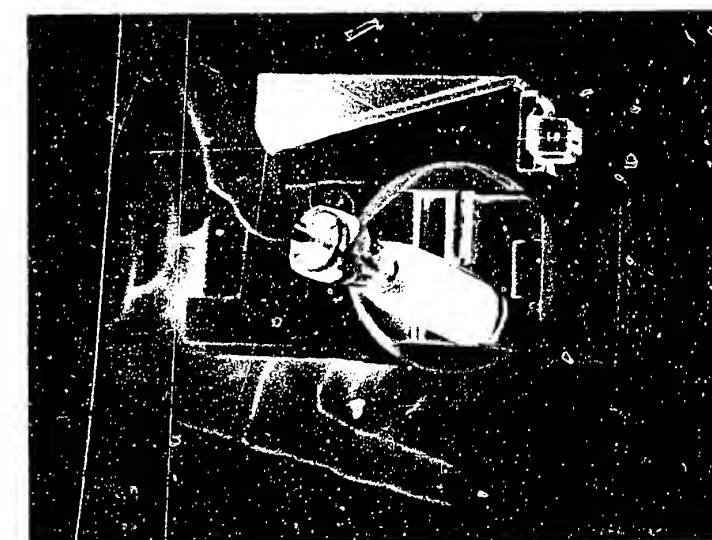
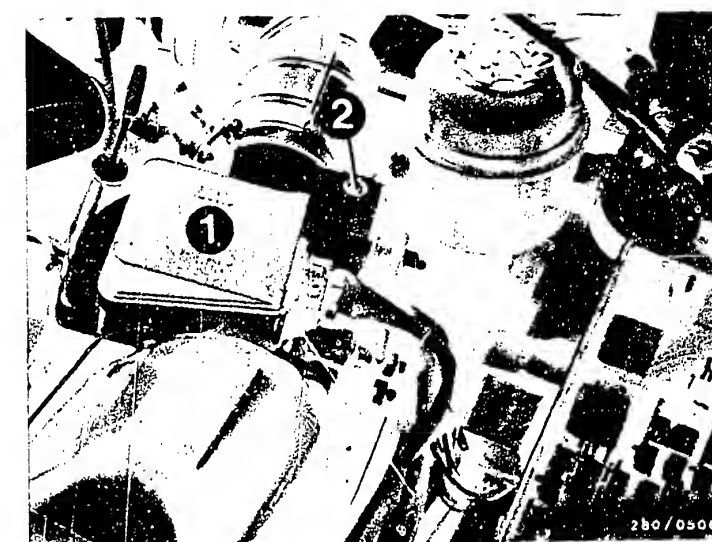
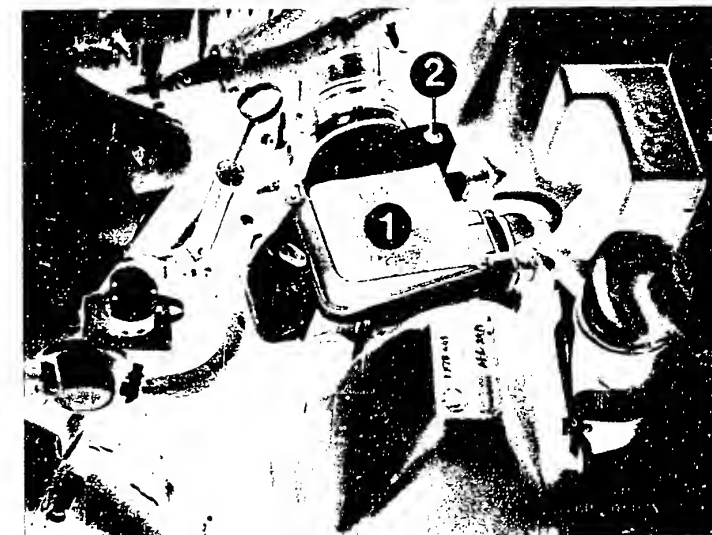
- 1 = Air-flow sensor
- 2 = CO adjusting screw

Middle illustration: 520i:

- 1 = Air-flow sensor
- 2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Continued on next picture page

* Check resistances:

Connect ohmmeter to terms. 8 and 9 of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and 5 of the air-flow sensor. Deflect sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air filter and air-flow sensor must be re-assembled.

Upper illustration: 320i / 323i:

1 = Air-flow sensor

2 = CO adjusting screw

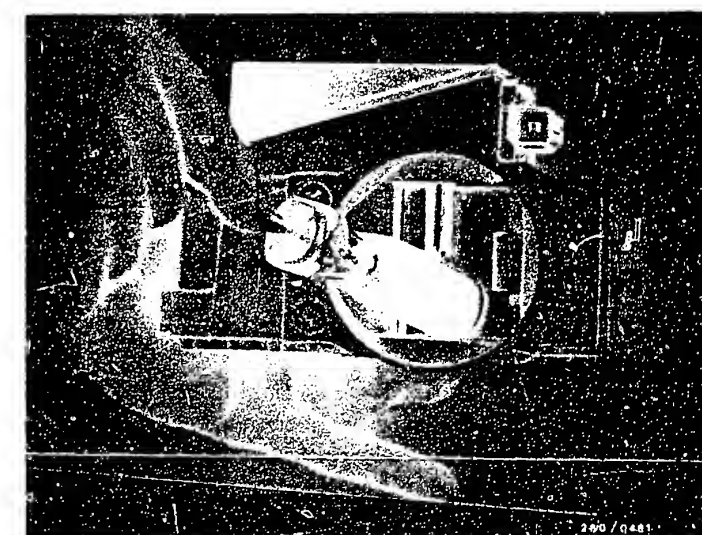
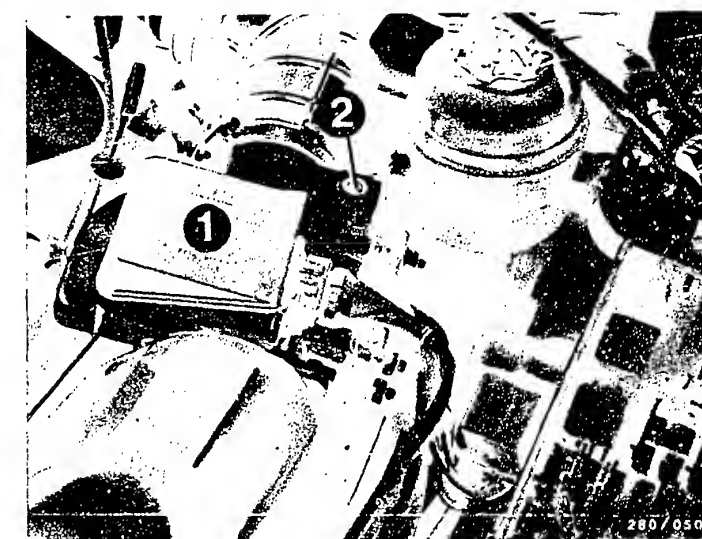
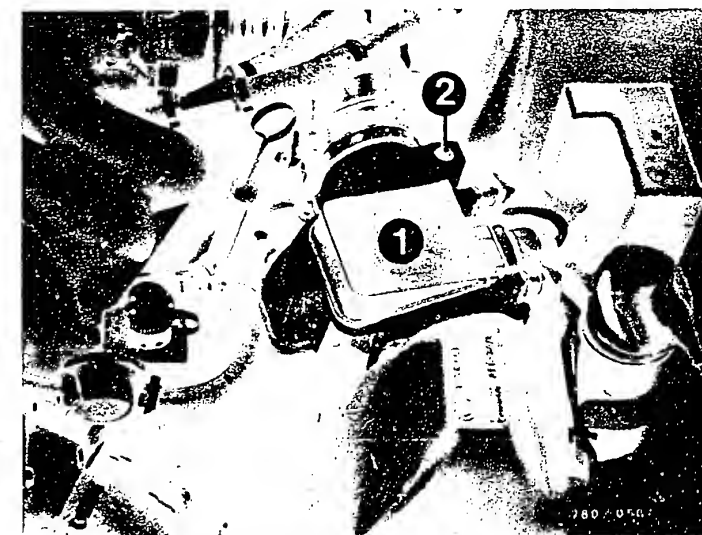
Middle illustration: 520i:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

Fuel consumption too high (continued 10)

Are CO and idle speed correctly set?

Test specification:

Idle speed:
750...850 min⁻¹

CO concentration

Europe:
less than 1.5 vol. % CO
Sweden/Switzerland version:
0.3 ... 0.6 vol. % CO.

Are specifications reached?

N>

Idle speed not adjustable.

Continued on next picture page

CO and idle setting

Europe version:

Exhaust setting using exhaust tester
with engine idling at operating
temperature.

* Idle speed:

Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹.

* CO setting:

Lower than 1.5 vol.% CO

Sweden/Switzerland version:

These vehicles are equipped with
secondary-air induction.

Test specification:

CO setting at 800 ... 900 min⁻¹ :
0.3 ... 0.6 vol.% CO (with hose
connected to air valves).

* Setting value in case of defect:

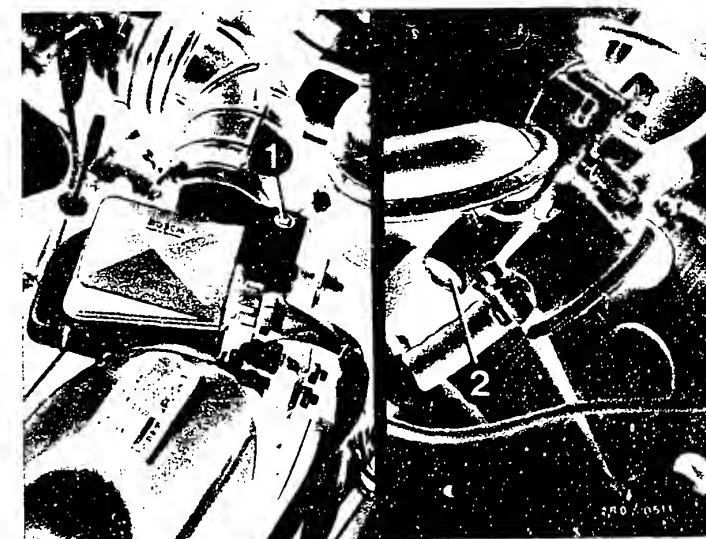
Idle speed: 750 ... 850 min⁻¹

CO setting:

0.8 ... 1.3 vol.% CO

with air-valve hose pulled and
sealed.

Continued on next picture page



1 = CO-adjusting screw

2 = Idle-speed adjusting screw

Trouble-shooting program for customer complaint

"fuel consumption too high"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04..
Direct trouble-shooting chart coordinates C05...C08..

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug.
Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

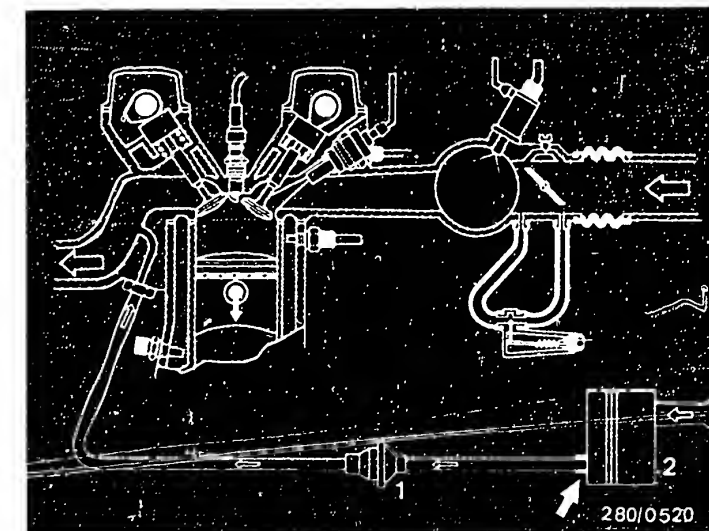
On all vehicles:

If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).
Check idle speed and CO concentration again. If necessary, make corrections in several steps.
After adjustment, use new (red) plugs (1 280 508 012).



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



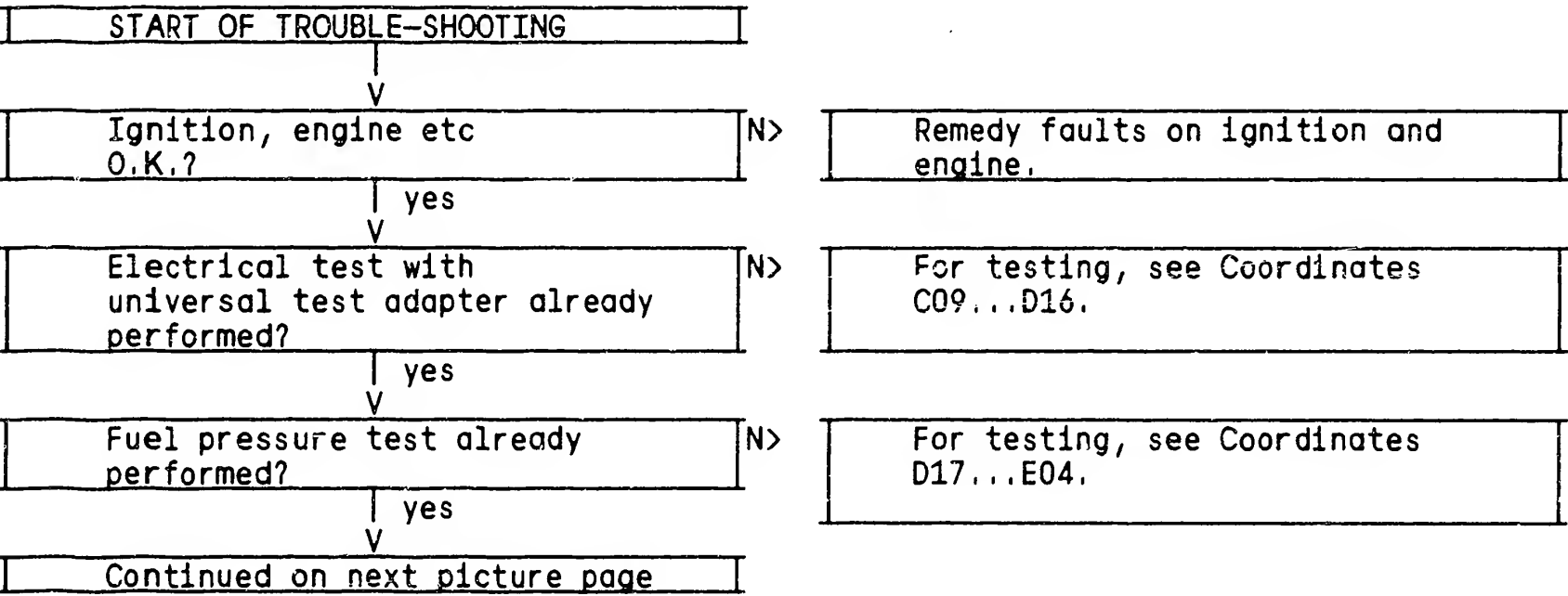
Trouble-shooting program according to customer complaints

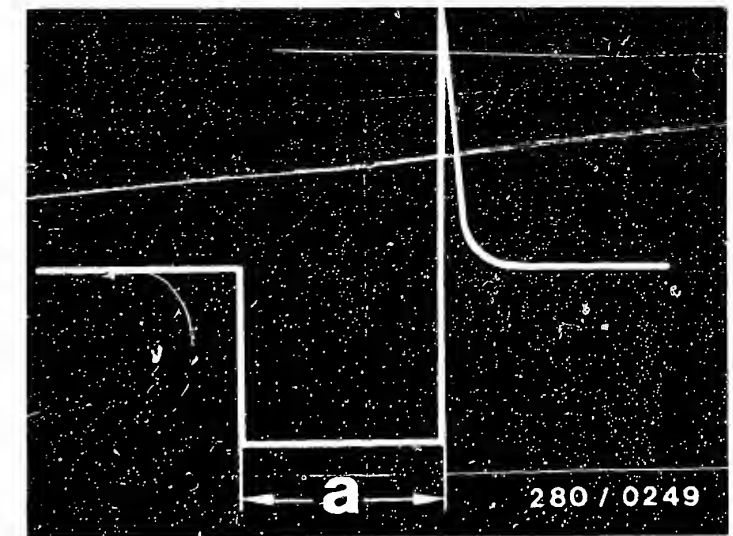
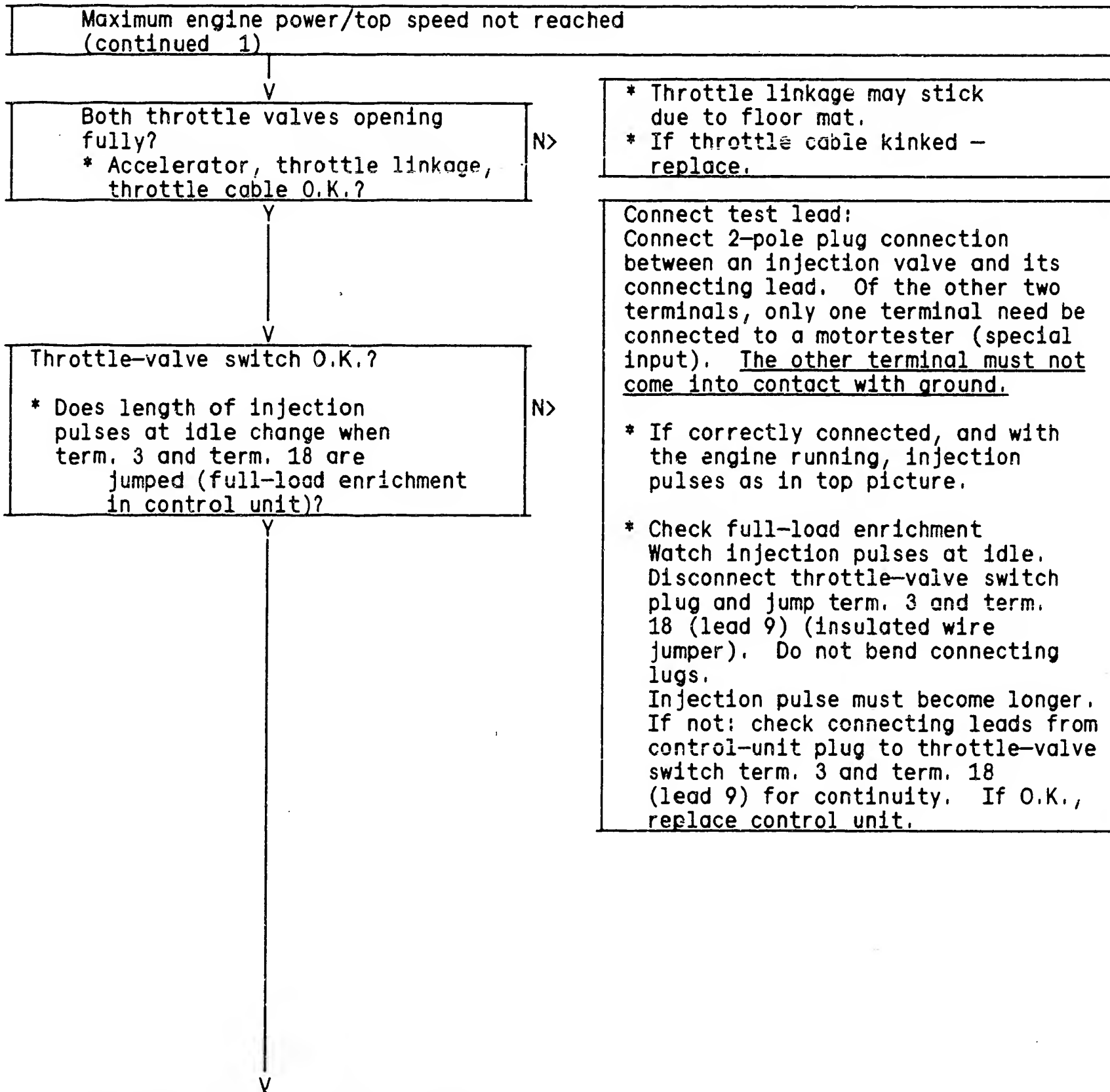
Procedure

The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

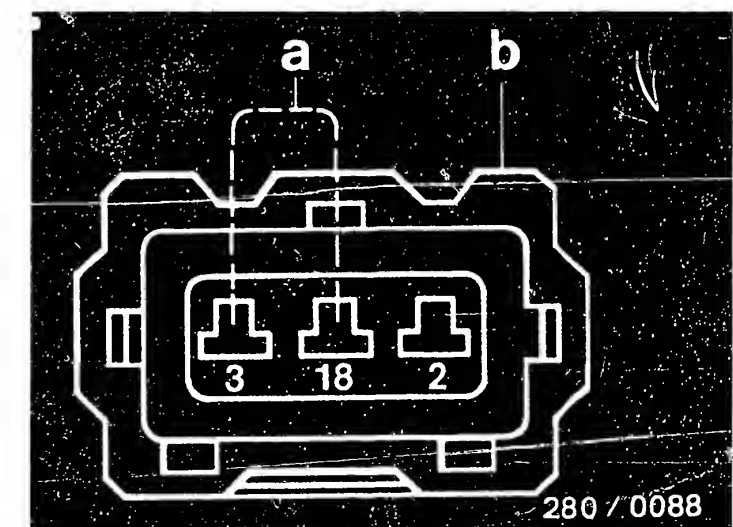
If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.





Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

a = Wire loop (insulated)
b = Throttle-valve switch, connection plug



Continued on next picture page

Maximum engine power/top speed not reached
(continued 2)

Is fuel delivery of electric fuel
pump O.K.?

Test specification, min.:

2.0 l engine:
min. 700 cm³ /30 s

2.3 l engine:
min. 750 cm³ /30 s

Is test specification reached?

N>

* Measure fuel quantity:

- Loosen junction between fuel-return
hose (from pressure regulator) and
fuel-return line (to fuel tank) for
testing.

- If necessary, lengthen hose and
insert into a 5 l receptical with
measuring scale.

- Disconnect control relay. Insert
cable bridge between term. 87b and
term. 30 in the plug base. Electric
fuel pump must be running.

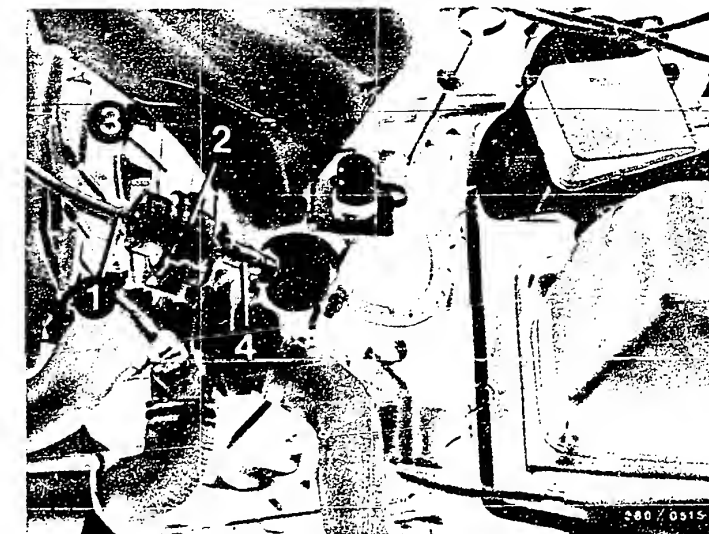
T E S T S P E C I F I C A T I O N:

2.0 l engine, min.
700 cm³ /30 s

2.3 l engine, min.
750 cm³ /30 s

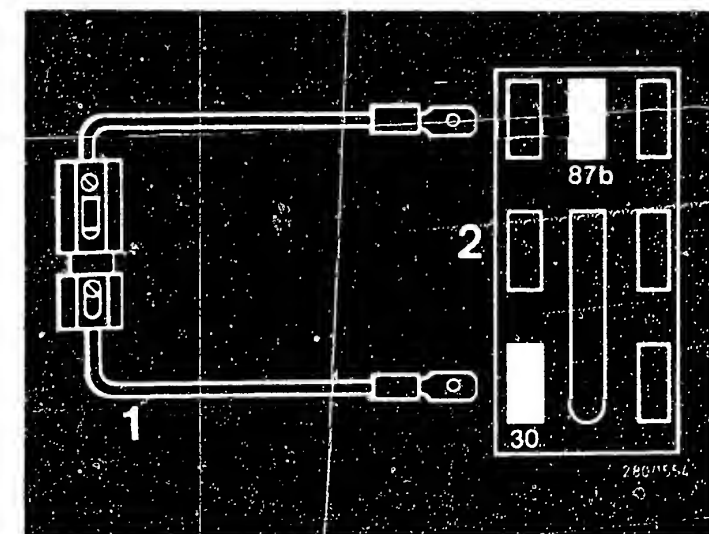
C A R E F U L !

Cable bridge must be removed after
testing has been completed.



1 = Intake manifold connection
2 = Pressure regulator
3 = Fuel-distribution pipe
4 = Fuel return line

1 = Jumper with fuse bracket and 10 A
fuse (user-fabricated)
2 = Top view of connection base
(3/5 series until 8.84 similar)



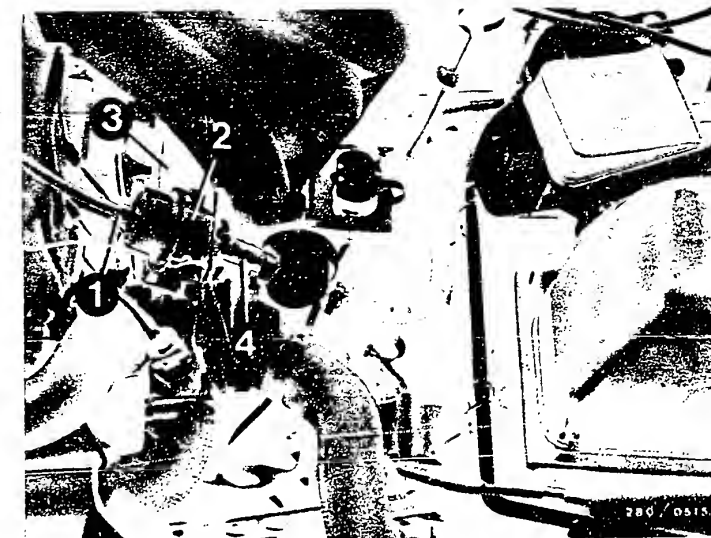
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Maximum engine power/top speed not reached
(continued 3)

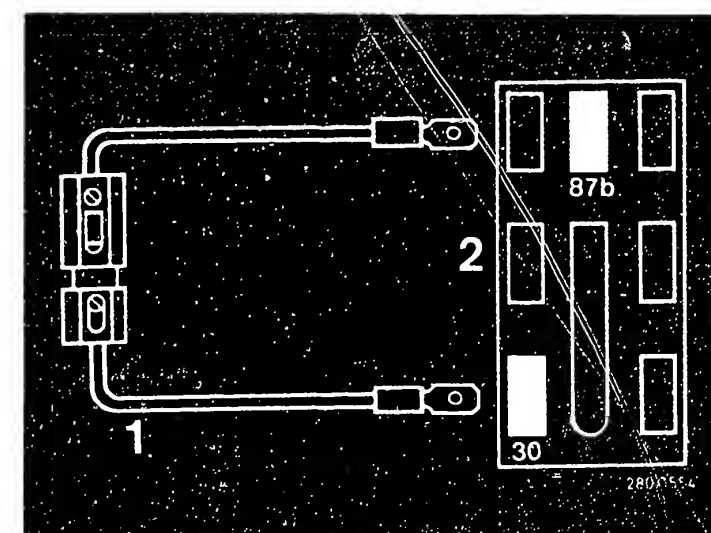
Remedy should measured value not be obtained:

- * Fuel filter clogged
→ renew.
- * Voltage at fuel-pump plugs at least 12 V with engine running. If this is not the case, clean contacts, eliminate poor ground connection if applicable, renew leads.
- * In-tank pre-supply pump (if applicable) defective → renew.
- * If pressure regulator defective → renew. The pressure regulator is attached to the fuel-distribution pipe with two fastening screws and via an O-ring. After removing the pressure regulator, the O-ring must be replaced as must the flat ring (use set of parts 1 287 010 704).
- * If fuel-pump output inadequate, replace electric fuel pump (beneath vehicle, on left, near rear axle).



- 1 = Intake manifold connection
- 2 = Pressure regulator
- 3 = Fuel-distribution pipe
- 4 = Fuel return line

- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
- 2 = Top view of connection base (3/5 series until 8.84 similar)



Continued on next picture page

Maximum engine power/top speed not reached
(continued 4)

Air-flow sensor mechanically
and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

Testing:

Loosen clamp fasteners on air filter,
lift off air filter upper section.

- * Test sensor flap for freedom of motion:

Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.

- * Mechanical test of air-flow sensor:

Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

Upper illustration: 3201/ 3231:

1 = Air-flow sensor

2 = CO adjusting screw

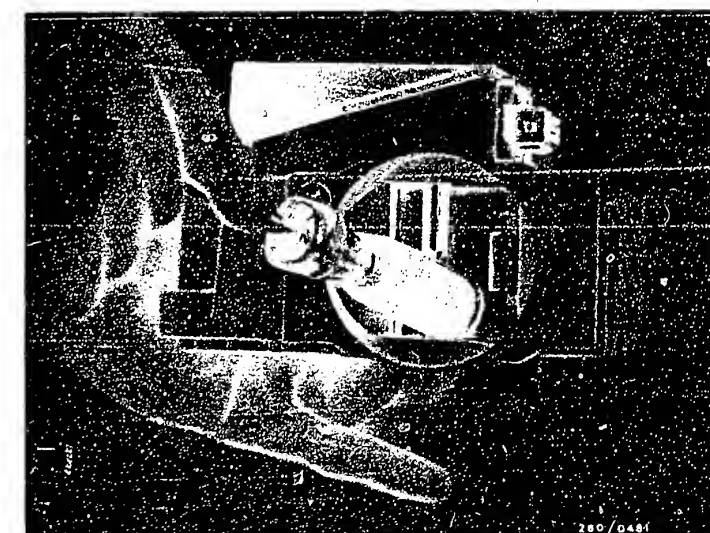
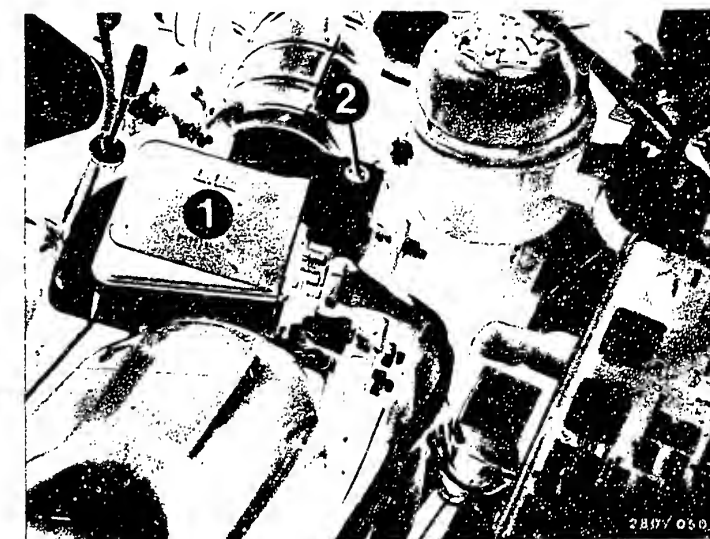
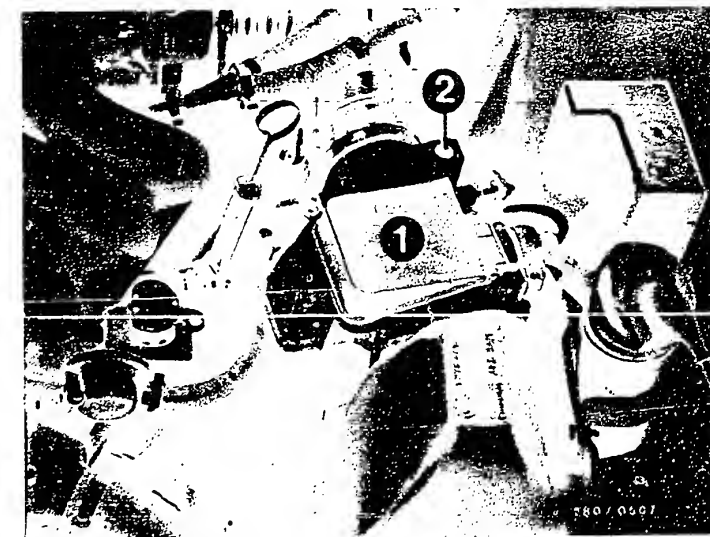
Middle illustration: 5201:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



Continued on next picture page

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Maximum engine power/top speed not reached
(continued 5)

* Check resistances:

Connect ohmmeter to terms. 8 and 9
of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and
5 of the air-flow sensor. Deflect
sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air
filter and air-flow sensor m u s t
be re-assembled.

Upper illustration: 320i / 323i:

1 = Air-flow sensor

2 = CO adjusting screw

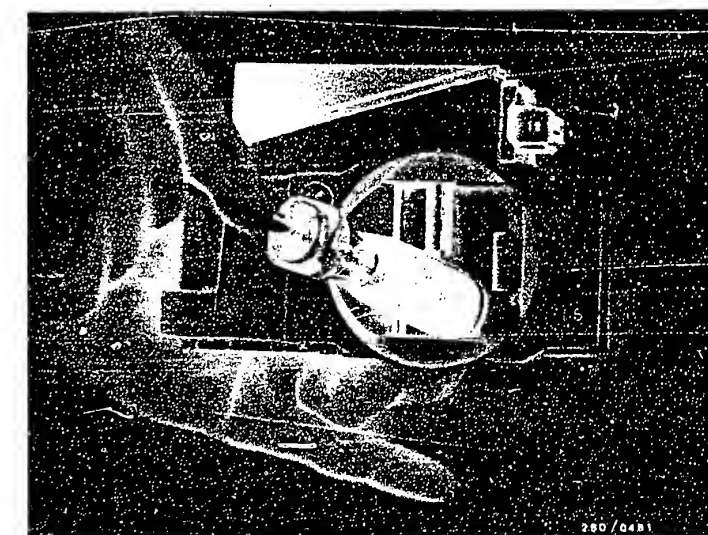
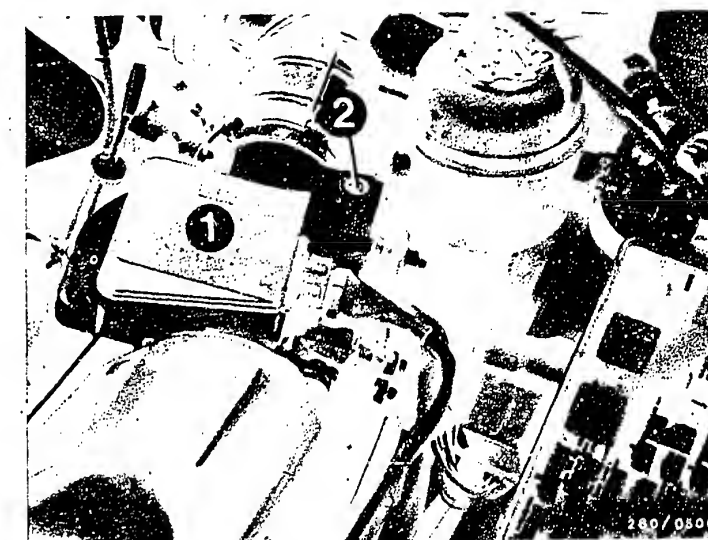
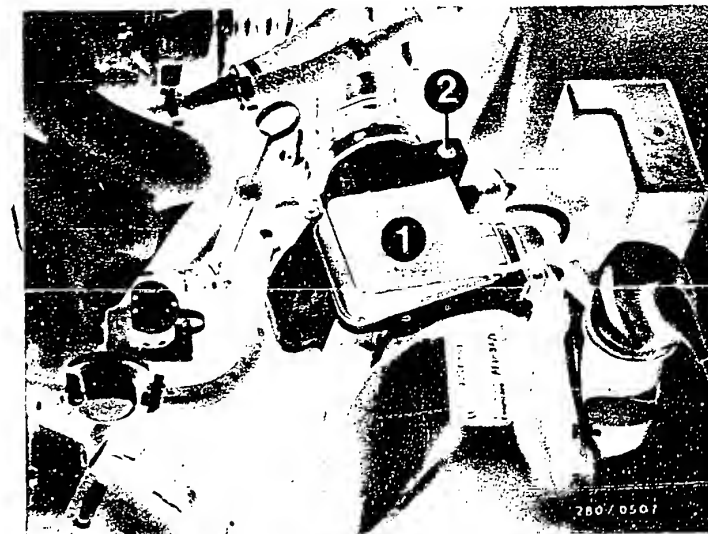
Middle illustration: 520i:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow
sensor.



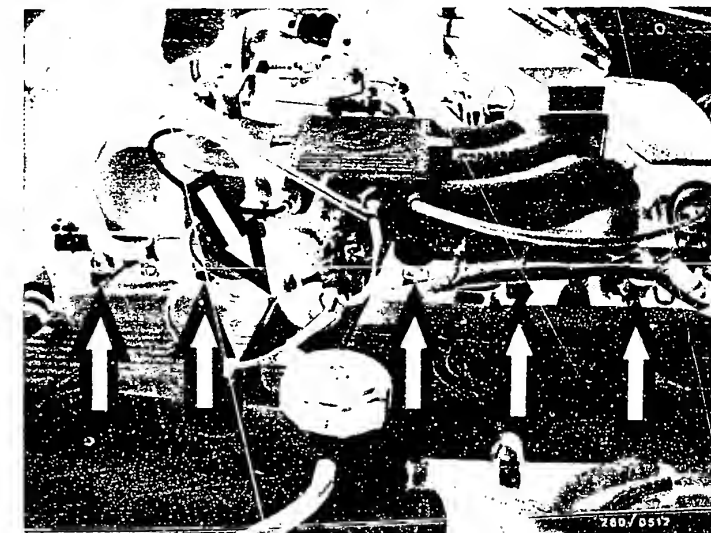
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Maximum engine power/top speed not reached
(continued 6)

Are solenoid-operated injection
valves in good mechanical and
hydraulic order?

N>

* Carry out mechanical and hydraulic
check of solenoid-operated injection
valves:
Let engine run at operating temperature
(+80°C). Pull solenoid-operated injection
valve plugs individually from the injection
valves one after the other and reconnect.
Engine speed should:
1. remain almost constant in case
of a defective injection valve.
2. sink considerably if the
injection valve is good.
Wait until you get a constant
engine speed.
Replace any defective solenoid-operated
injection valves.



Arrows = Injection valves

Continued on next picture page

Maximum engine power/top speed not reached
(continued 7)

Are all hose lines correctly
connected, not kinked or
damaged?

Visual examination.

* Air-intake system checked for
leaks with 0.3 bar gauge
pressure?

N>

* Check whether hoses of air-intake
system and fuel-line system are
correctly connected, not kinked
or damaged. If necessary,
replace hoses.
Eliminate leaks by means of new
seals or by retightening the
connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew
air-flow sensor from air-filter
housing and seal off air-flow sensor
duct.

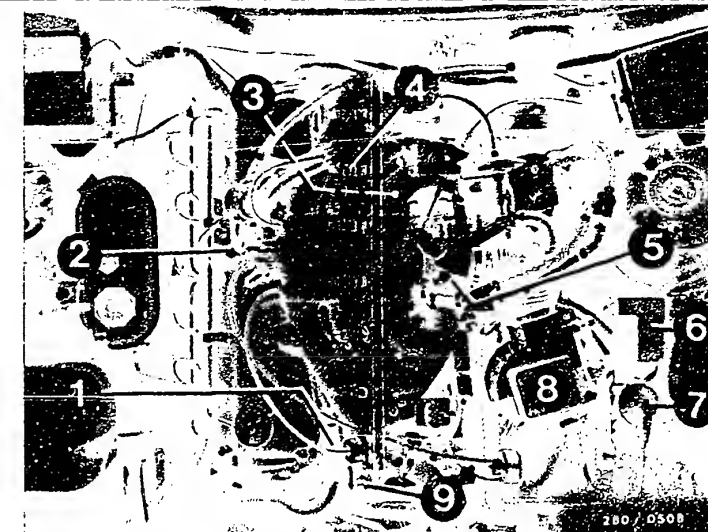
Disconnect hose after auxiliary-air
device and, using a compressed-air
gun, blow air (0.3 bar gauge
pressure) into the intake manifold.
Seal off connection port on
auxiliary-air device.

Open throttle valve fully while
doing this.

Brush or spray all joints with soapy
water.

Leaks may also occur at the
following points on the engine:
Oil dipstick not securely inserted,
defective lid seal on oil filler
neck etc.

Bubbling or foaming indicates a
leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection
valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

Continued on next picture page

Continued on next picture page

Maximum engine power/top speed not reached
(continued 8)

Sweden/Switzerland version

Secondary-air induction is installed here as an additional measure for reducing pollutants in the exhaust.

* Leak test:

In addition, the lines for the secondary-air induction must be inspected along with the air valves.

Trouble-shooting program for customer complaint

"maximum engine power/top speed not reached"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03...C04.
Direct trouble-shooting chart coordinates C05...C08.

Trouble-shooting program according to customer complaintsProcedure

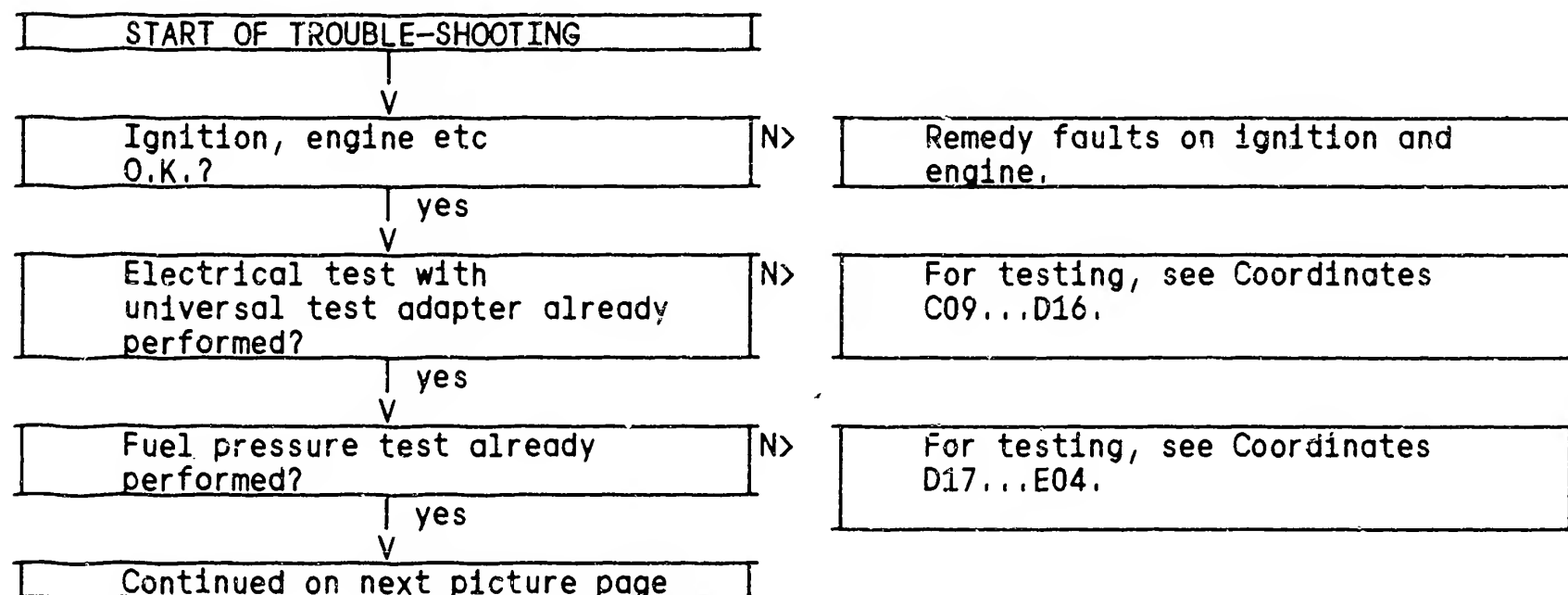
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Idle speed and CO concentration too low or too high (continued 1)

Are CO and idle speed correctly set?

Test specification:

Idle speed:
750...850 min⁻¹

CO concentration
Europe:
less than 1.5 vol. % CO
Sweden/Switzerland version:
0.3 ... 0.6 vol. % CO.

Are specifications reached?

N>

CO and idle setting

Europe version:
Exhaust setting using exhaust tester
with engine idling at operating
temperature.

* Idle speed:
Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹

* CO setting:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
These vehicles are equipped with
secondary-air induction.

Test specification:
CO setting at 800 ... 900 min⁻¹ :
0.3 ... 0.6 vol.% CO (with hose
connected to air valves).

* Setting value in case of defect:
Idle speed: 750 ... 850 min⁻¹
CO setting:
0.8 ... 1.3 vol.% CO
with air-valve hose pulled and
sealed.



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

Idle speed not adjustable.

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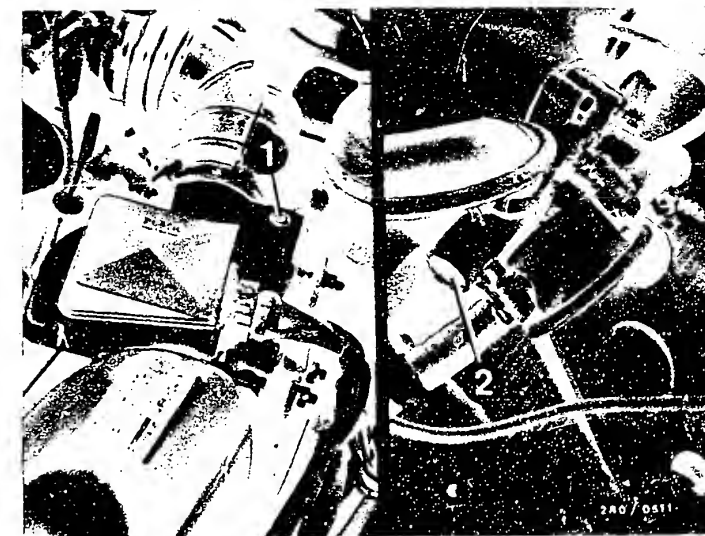
When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug.

Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

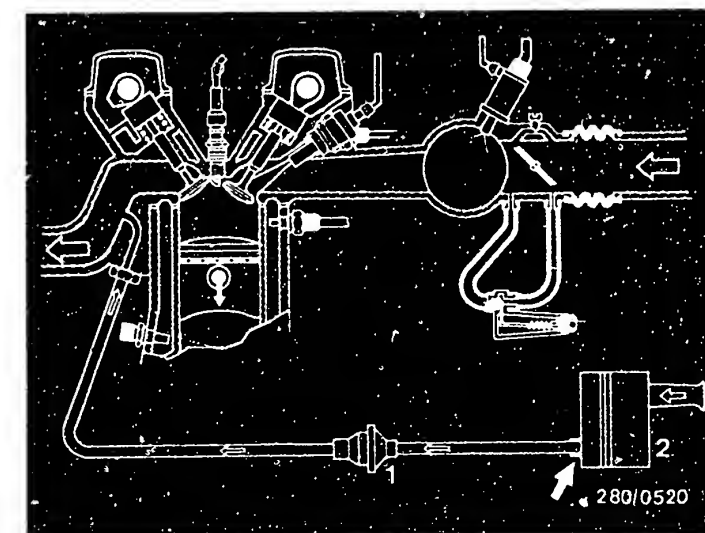
If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm).

Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



Continued on next picture page

Idle speed and CO concentration too low or too high (continued 3)

Auxiliary-air device mechanically
O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose
pinched off

N>

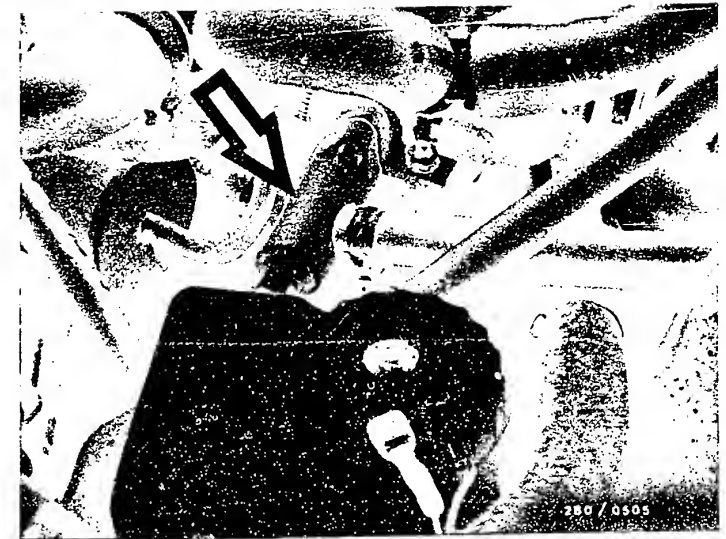
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down
(possibly using a small mirror).
When cold, the cross section must be
partially open; when the engine is
warm, it must be closed. If not,
replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose
to auxiliary-air device. Engine
speed must drop. With engine warm,
pinch off hose to auxiliary-air
device. There must be no noticeable
drop in engine speed. If not,
replace auxiliary-air device (paying
attention to direction of flow).



Arrow = Auxiliary-air device

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

Testing:

Loosen clamp fasteners on air filter, lift off air filter upper section.

- * Test sensor flap for freedom of motion:
Open sensor flap by hand. Sensor flap must be able to be opened with equal ease up to stop and should then close itself fully. Sensor flap must not catch when opening.
- * Mechanical test of air-flow sensor:
Look for signs of wear. Clean out the inside of dirty air-flow sensors and wipe with a lint-free cloth. If there are signs of abrasion, the air-flow sensor must be replaced. Sensor flap must return to neutral position. If it does not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.

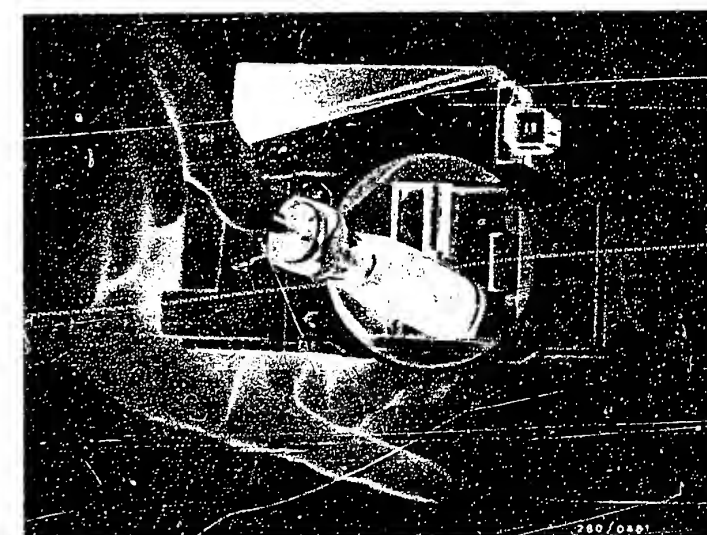
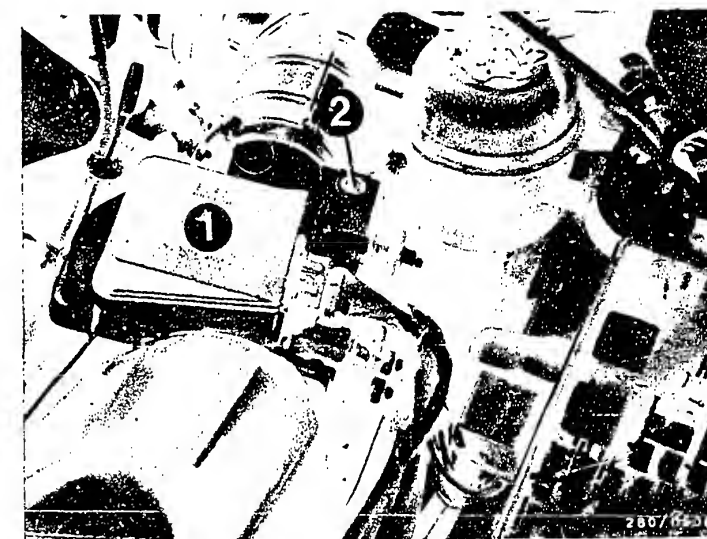
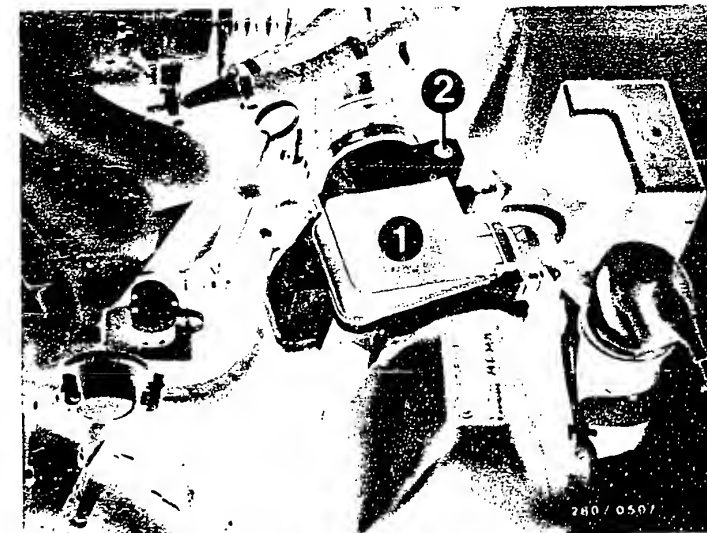
Upper illustration: 3201/ 3231:

- 1 = Air-flow sensor
- 2 = CO adjusting screw

Middle illustration: 5201:

- 1 = Air-flow sensor
- 2 = CO adjusting screw

Lower illustration:
Push on sensor flap in air-flow sensor.



Continued on next picture page

Continued on next picture page

V

* Check resistances:

Connect ohmmeter to terms. 8 and 9 of the air-flow sensor.

Test specification: 160... 300 Ω

Connect ohmmeter to terms. 7 and 5 of the air-flow sensor. Deflect sensor flap all the way.

Test specification: 60...1000 Ω

C a r e f u l !

After completing testing, the air filter and air-flow sensor must be re-assembled.

Upper illustration: 320i / 323i:

1 = Air-flow sensor

2 = CO adjusting screw

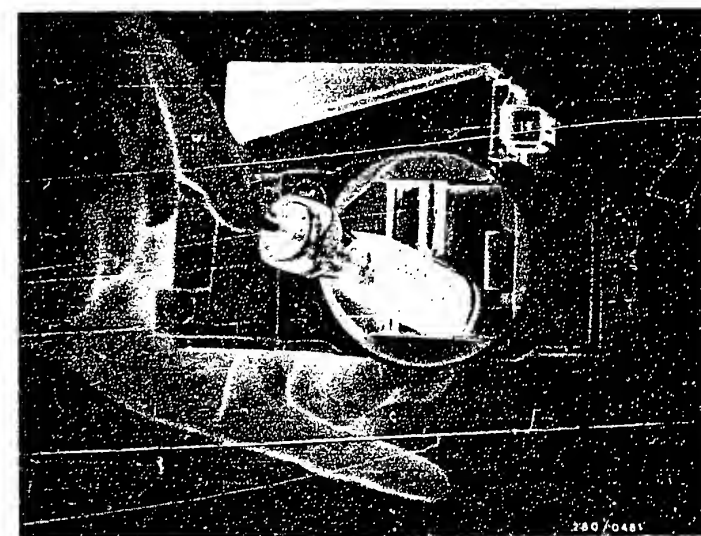
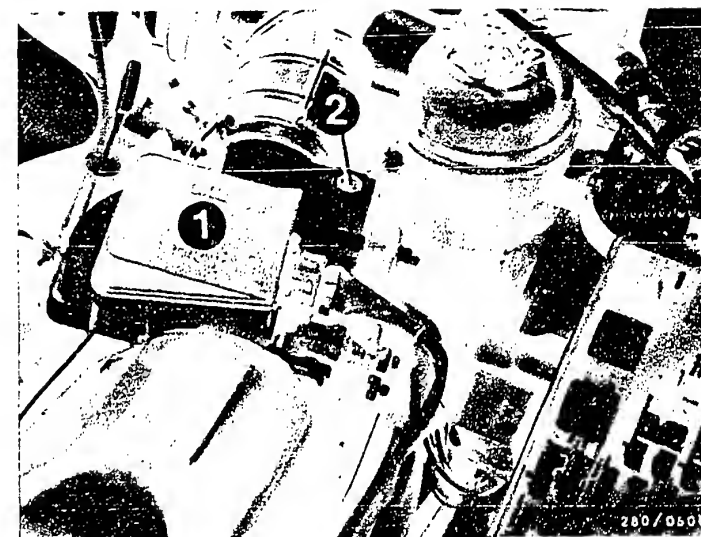
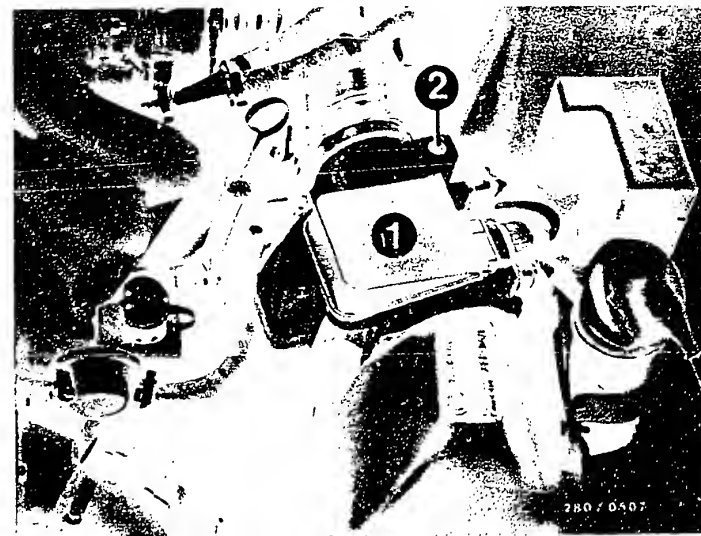
Middle illustration: 520i:

1 = Air-flow sensor

2 = CO adjusting screw

Lower illustration:

Push on sensor flap in air-flow sensor.



V

Continued on next picture page

Is measured CO value below tolerance?

Europe version:
max. 1.5 vol.% CO

Sweden/Switzerland version:
max. 0.6 vol.% CO

Until 8.84:
Is start valve O.K.?

As of 9.84:
Is sealing of injection valves O.K.?

N>

* Until 8.84:

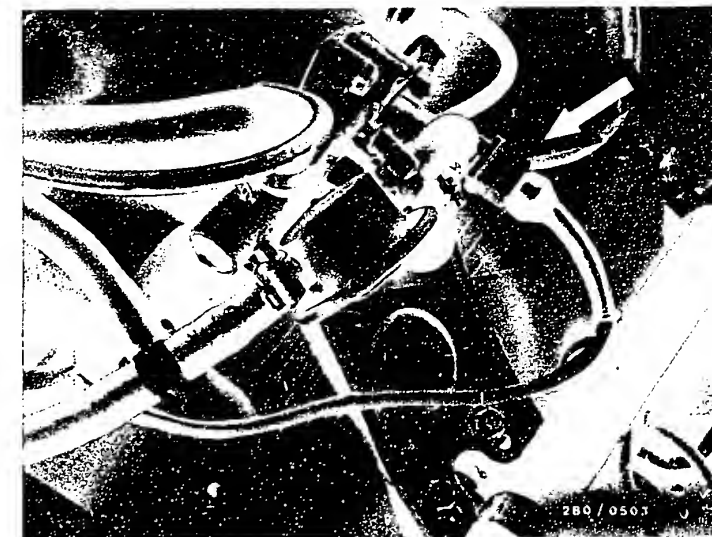
Leak test of solenoid-operated cold-start valve

1. In installed condition: Pinch off fuel delivery line at start valve. If engine subsequently runs smoothly, replace start valve.
2. When removed: Remove start valve (C a r e f u l , f i r e h a z a r d !). Fuel lines and electrical leads remain connected (place catch receptical underneath start valve!). Generate fuel pressure (disconnect control relay, insert cable bridge between terms. 87b and term. 30 in connection socket).

T e s t s p e c i f i c a t i o n :
Within one minute a maximum of 1 drop may form at the valve opening.

N o t e !

Bridge must be removed after testing has been completed, and the control relay re-connected.



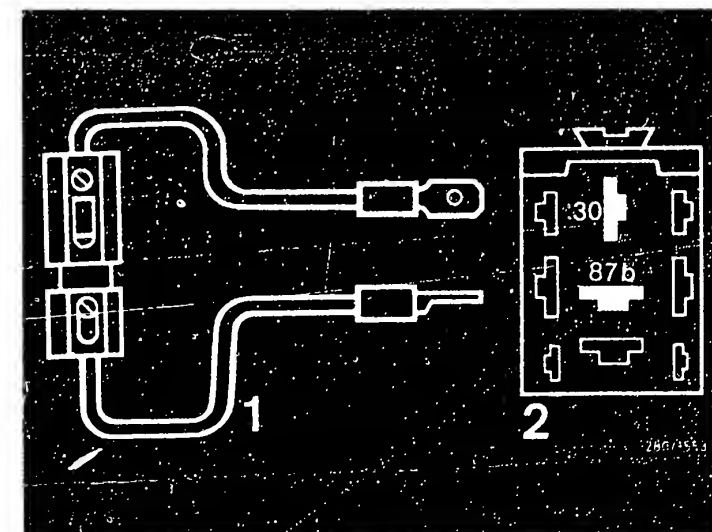
Arrow = Solenoid-operated cold-start valve (blue plug)

Cable bridge

(user-fabrication)

1 = Fuse holder with 10 A fuse

2 = Top view of connection socket (3201 / 3231 version similar until 8.84)



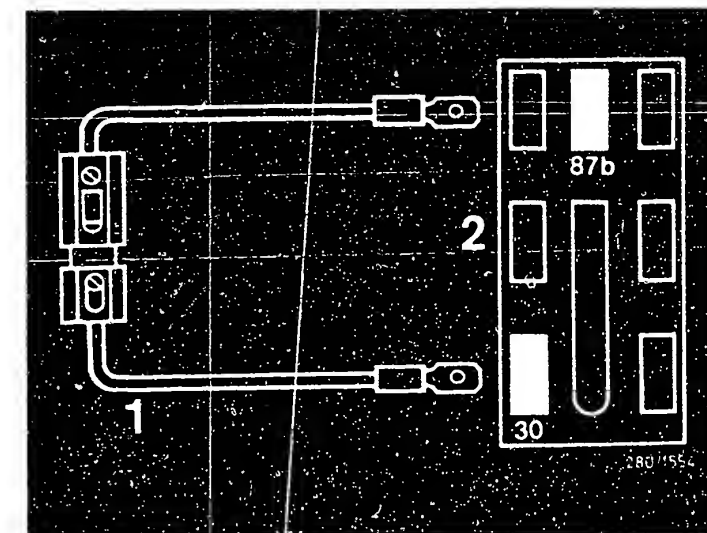
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As of 9.84:

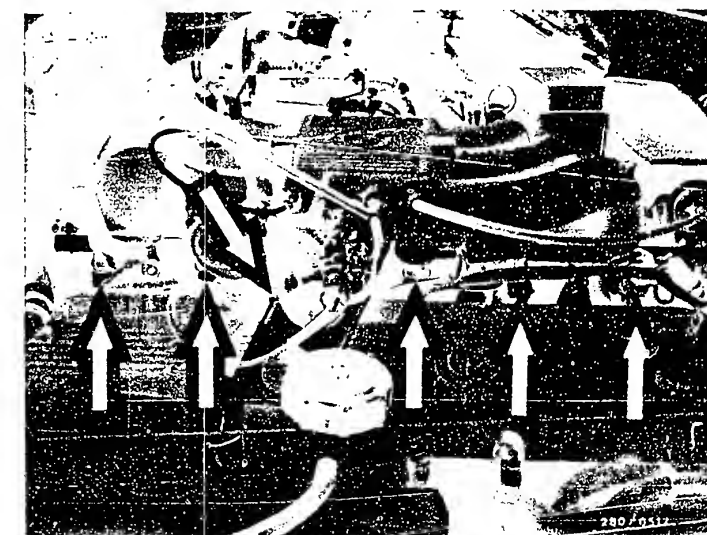
Leak test of solenoid-operated injection valves:

- * Remove fuel-distribution pipe with injection valves.
 - Loosen fastening screws on fuel-distribution pipe.
 - Pull all 6 injection valves simultaneously and carefully from the cylinder head.
 - * Build up fuel pressure:
 - Disconnect control relay.
 - Insert cable bridge between term. 7b and 30 in the connection base.
 - Ignition on. Electric fuel pump must be running.
 - Test specification: Within 60 sec. no drops should form at the injection-valve opening. In case of defect replace injection valve.
 - * Removal
 - Pull electrical connection.
 - Carefully push holding clamp out of groove.
 - Carefully pull injection valve out of fuel-distribution pipe.
- C A R E F U L !**
Catch any fuel running out. Do not allow to drop onto hot engine parts.



- 1 = Jumper with fuse bracket and 10 A fuse (user-fabricated)
- 2 = Top view of connection base (3/5 series until 8.84 similar)

Arrows = Injection valves



Continued on next picture page

Continued on next picture page

* Installation

C a r e f u l !

Prior to installation the two O-rings must be only lightly lubricated with clean engine oil, e.g. HD30.

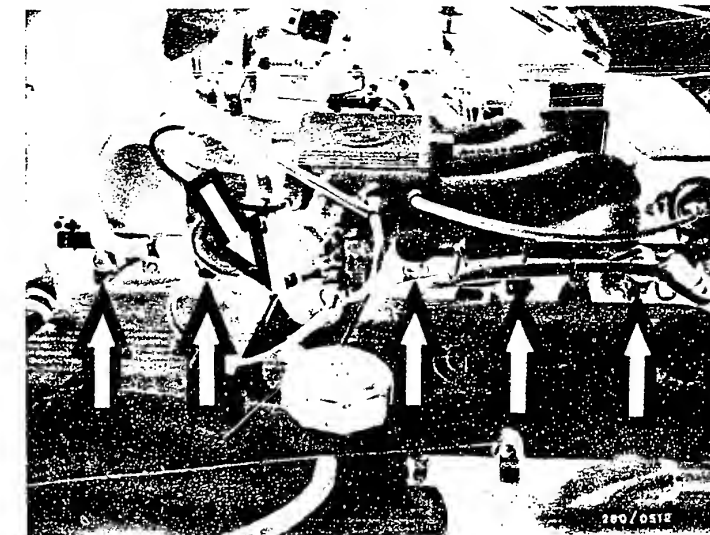
The other solenoid-operated injection valve parts must remain oil-free.

- Carefully plug new injection valve onto fuel-distribution pipe.

- Push holding clamp into the groove in the injection valve until the clamp engages.
(Check sealing of junction).

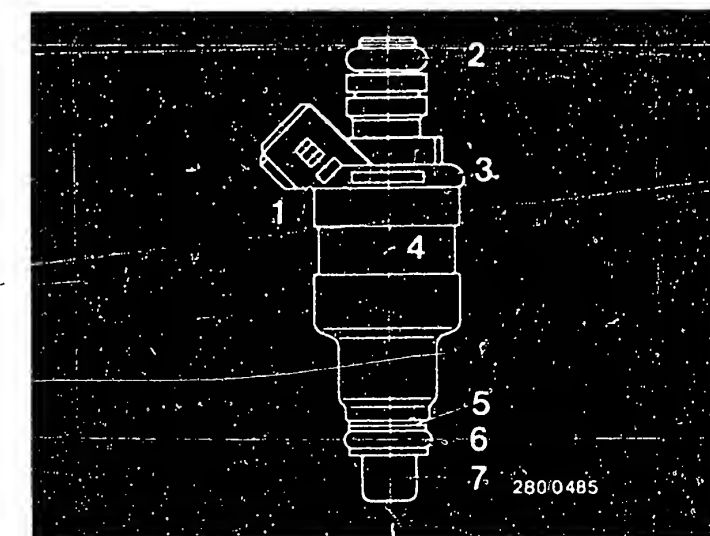
N o t e !

After testing restore to original installed position. Test for leakage (outside air).



Arrows = Injection valves

- 1 = Date of manufacture
- 2 = Upper O-ring
- 3 = Part number
- 4 = Solenoid-operated injection valve
- 5 = Supporting plate (yellow, 2 mm)
- 6 = Lower O-ring
- 7 = Protection sleeve



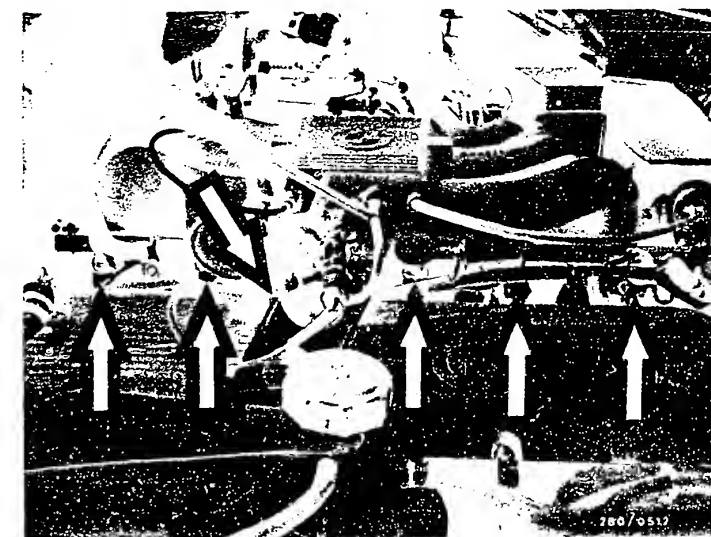
Continued on next picture page

Idle speed and CO concentration too low or too high (continued 9)

Are solenoid-operated injection valves in good mechanical and hydraulic order?

N>

* Carry out mechanical and hydraulic check of solenoid-operated injection valves:
Let engine run at operating temperature (+80°C). Pull solenoid-operated injection valve plugs individually from the injection valves one after the other and reconnect. Engine speed should:
1. remain almost constant in case of a defective injection valve.
2. sink considerably if the injection valve is good.
Wait until you get a constant engine speed.
Replace any defective solenoid-operated injection valves.



Arrows = Injection valves

Continued on next picture page

Start control (control-unit function)
in order? (As of 9.84)

- * Connect test lead between one solenoid-operated injection valve.
- * Pull blue plug from temperature sensor II (engine).
- * Connect motortester or multimeter to test lead (position V, measuring range 10 V).
- * Pull out pump fuse.
- 5 series no. 1.
- 3 series no. 11.
- * Disconnect ignition lead at ignition coil term. 4 and connect ignition coil term. 4 to ground via a series resistor and a spark gap or connect the ignition-coil-capacitor tester.

Start engine.

Engine must not start. Does voltage at solenoid-operated injection valve fall during starting from approx. 4 V to approx. 0,5 V?

(With engine at operating temperature or connected NTC II plug the initial voltage is below 0.5 V).

After testing restore to original installed condition.

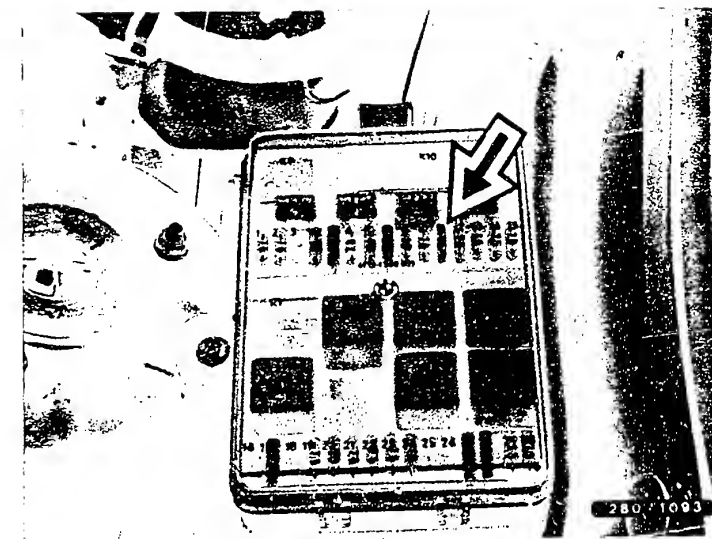
N>

Function test:

- * Remove pump fuse (in central fuse box).
- 5 series no. 1.
- 3 series no. 11.
- * Disconnect ignition lead at ignition coil term. 4 and connect ignition coil term. to ground via a series resistor and spark gap (ignition-coil-capacitor tester 0 681 100 001).
- (Careful! Engine must not start).

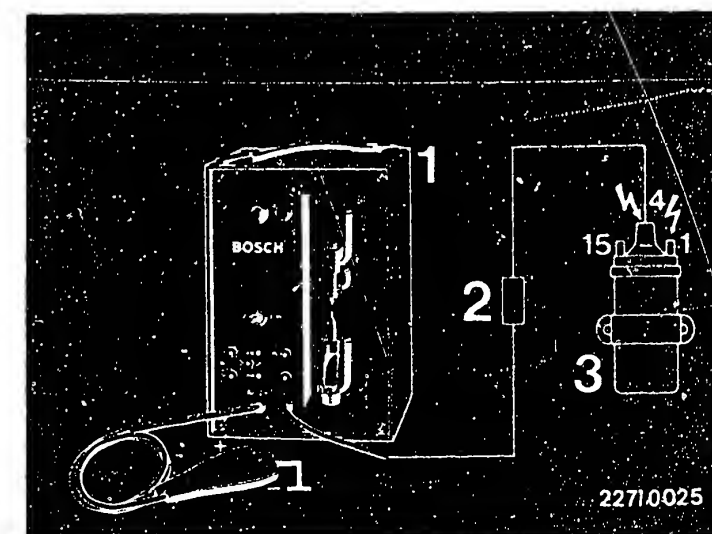
C a r e f u l !

When using a spark gap an interference-suppression resistor of at least 2 k Ω e.g., sleeve-type suppressor (5 k Ω) 0 356 500 001, must be connected between the spark gap and ignition coil term. 4, in order to prevent irreparable damage to the trigger box.



Arrow = Pump fuse
3 series no 11,
5 series no. 1

1 = Ignition-coil-capacitor tester
or spark gap
2 = 5 k Ω sleeve-type suppressor
3 = Ignition coil
C a r e f u l !
Hazardous voltages
(400 V – 25 kV)
at terms. 1 and 4.



Continued on next picture page

Continued on next picture page

* Connect 2-pin adapter lead

between a solenoid-operated injection valve and its electrical connecting cable.

* Connect multitester or motortester to free test pin.

Measurement range approx. 10 V.

* Pull cable plug from temperature sensor II (engine) (blue plug)

Measurement

* Start engine

* Voltage reading falls from initial approx. 1 684 463 093 V within approx. 4 s of

starting to approx. 15 V.

If these values are not reached → replace control unit.

* Voltage testing cannot be repeated until after approx. 1 minute.

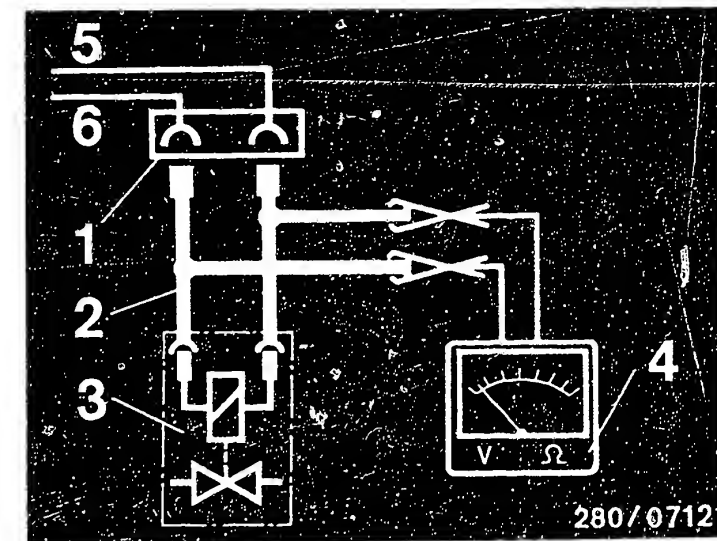
* Connect cable plug to temperature sensor. Engine at operating temperature.

Start → voltage reading lower than 0.5 V.

If not → replace temperature sensor II.

Note!

After testing, restore to original installed condition.



1 = Plug connector of injection-valve cable

2 = Test lead 1 684 463 093

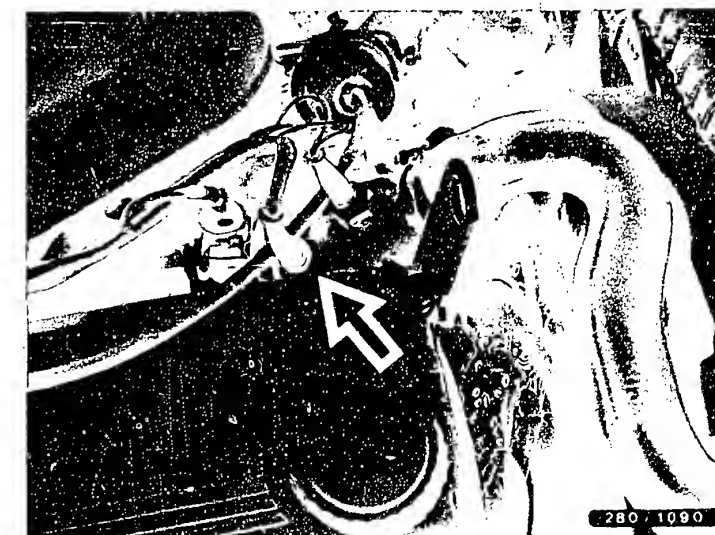
3 = Solenoid-operated injection valve

4 = Multimeter or motortester

5 = From control relay term. 87

6 = From control relay term. 12/24

Arrow = Temperature sensor II (engine) on engine block (blue plug)



Continued on next picture page

Is measured CO value above

0.2 vol.% CO?

N>

Is induction system sealed?

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses. Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.

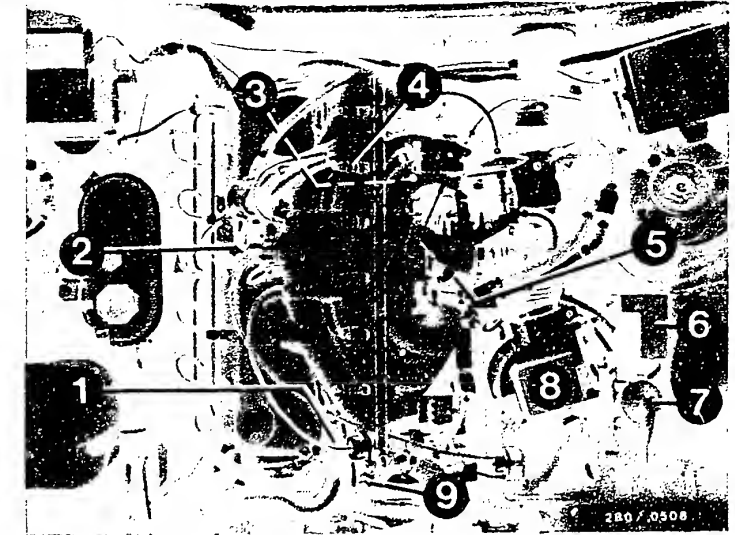
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold. Seal off connection port on auxiliary-air device.

Open throttle valve fully while doing this.

Brush or spray all joints with soapy water.

Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.

Bubbling or foaming indicates a leak.



3 series (5 series similar)

1 = NTC II

2 = Start valve (n/a as of 9.84)

3 = Ground terminals

4 = Solenoid-operated injection valves

5 = Throttle-valve switch

6 = Control relay

7 = Ignition coil

8 = Air-flow sensor

9 = Thermo-time switch
(n/a as of 9.84)

Continued on next picture page

Idle speed and CO concentration too low or too high (continued 13)

Are CO concentration and idle speed correctly set?
(Repeat)

Test specification:
Idle speed:
750...850 min⁻¹

CO concentration
Europe:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
0.3...0.6 vol.% CO

Are test specifications reached?

N>

Idle speed not adjustable.

Continued on next picture page

CO and idle setting

Europe version:
Exhaust setting using exhaust tester with engine idling at operating temperature.

* Idle speed:
Manual and automatic transmission
(selector lever in "P" position):
750...850 min⁻¹

* CO setting:
Lower than 1.5 vol.% CO

Sweden/Switzerland version:
These vehicles are equipped with secondary-air induction.

Test specification:
CO setting at 800 ... 900 min⁻¹;
0.3 ... 0.6 vol.% CO (with hose connected to air valves).

* Setting value in case of defect:
Idle speed: 750 ... 850 min⁻¹
CO setting:
0.8 ... 1.3 vol.% CO
with air-valve hose pulled and sealed.

Continued on next picture page



1 = CO-adjusting screw

2 = Idle-speed adjusting screw

Idle speed and CO concentration too low or too high (continued 14)

V

When adjusting idle and CO concentration, the secondary-air induction must be rendered inoperative. To do this, pull the hose between the air valve and air filter at the air filter (arrow) and tightly seal with a plug. Deactivation of secondary-air induction in operation of the vehicle in countries without restrictive exhaust regulations is not necessary.

On all vehicles:

If CO concentration is too high, unscrew the bypass screw (CO-adjustment screw) in the air-flow sensor by a half turn counter-clockwise (Allen-head screw, A/F = 5 mm). Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjustment, use new (red) plugs (1 280 508 012).

Trouble-shooting program for customer complaint

"Idle speed and CO concentration too low or too high"

completed.

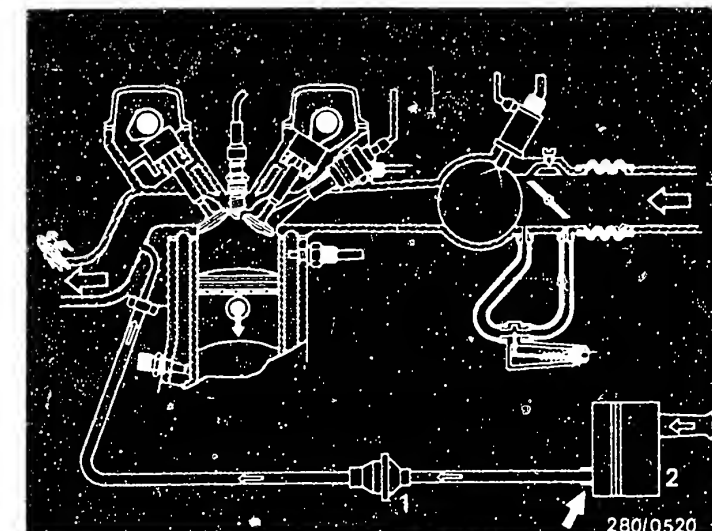
If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates C03/C04.,
Direct trouble-shooting chart coordinates C05...C08.,



1 = CO-adjusting screw
2 = Idle-speed adjusting screw

1 = Air valve
(non-return valve)
2 = Air filter



PLUG CONNECTORS FOR JETRONIC COMPONENTS

|28|
VDT-I-280/111 En
11.1984

Parts sets (supersedes Ed. 11.1982)

Parts sets are available for the replacement of Jetronic plug connectors. The parts sets consist of:

- * Plug connector housing
- * Protective cap (rubber sleeve)
- * Contact springs

These parts are listed on microcard EE... 1).
see microcard EEOO under 280 ...

* Plug, black, 2-pole,
Parts set 1 287 013 002 cable connector in
conjunction with socket, 2-pole.

* Socket, black, 2-pole,
Parts set 1 287 013 001 for e.g.:
Temperature sensor 0 280 130 0..
Auxiliary-air device 0 280 140 ..
Thermo-time switch 0 280 130 2..
Start valve 0 280 170 ..
Warm-up regulator 0 438 140 ..

* Socket, gray, 2-pole
Parts set 1 287 013 003 for:
Injection valve 0 280 150 ..

* Socket, black, 3-pole,
Parts set 1 237 000 039 for:
Throttle-valve switch 0 280 120 ..

* Socket, black, 5-pole,
Parts set 1 287 013 006 for:
Air-flow sensor 0 280 20. ..
(LE version)

* Socket, black, 6-pole,
Parts set 1 287 013 004 for:
Air-flow sensor 0 280 200 ..

* Socket, black, 7-pole,
Parts set 1 287 013 005 for:
Air-flow sensor 0 280 20. ..
Air-flow sensor 0 280 211 ..

* Wiring-harness plug connector, black,
25-pole,
Parts set 1 287 013 009 for:
Control unit 0 280 0..

* Wiring harness plug connector, black,
35-pole,
Parts set 1 287 013 008 for:
Control unit 0 280 0..

The contact springs (minitimers) are also
available separately under
Part No. 1 284 477 026.

The plug connector housings are available
only in the stated colors.

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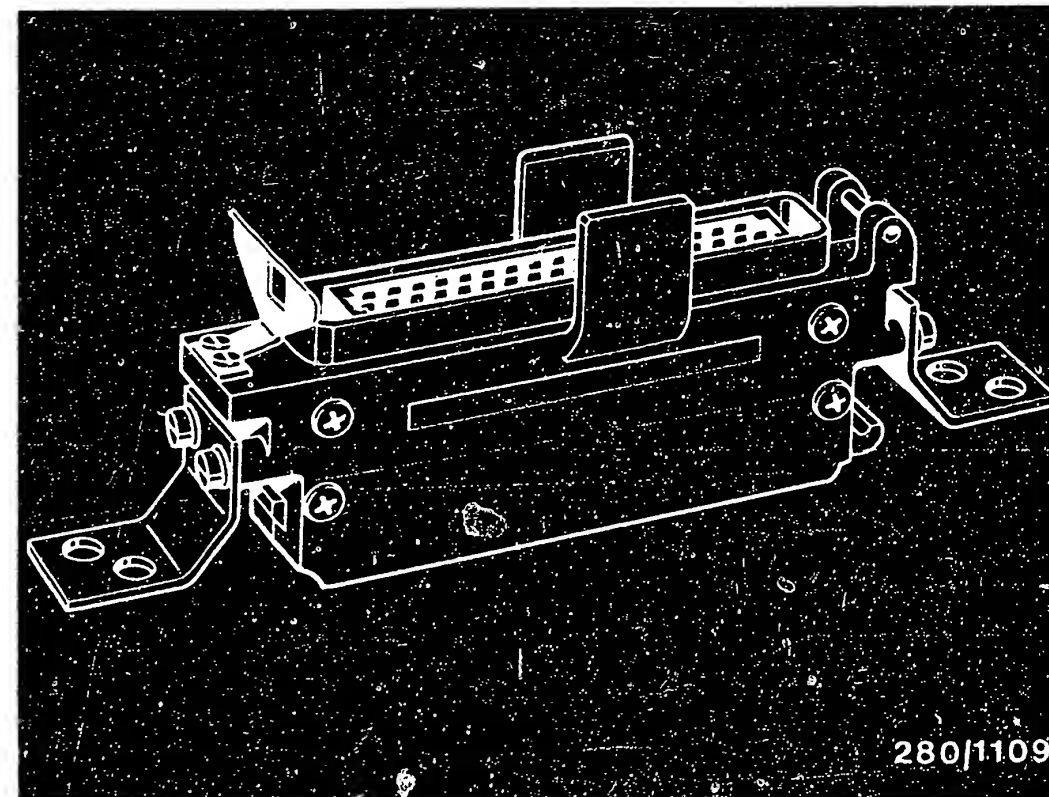
Please direct questions and comments
concerning the contents to our authorized
representative in your country.

MOBILE AND BUILT-IN TRANSMITTERS IN VEHICLES WITH L-/LE-JETRONIC
Influence on engine running (replaces edition of 04.1981) and remedial measures

|28|
VDT-I-280/106 En
09.1984

If interference with the driving operation (engine bucking, goes out, etc.) should occur in vehicles having L-/LE-Jetronic in which built-in or mobile radio equipment is operated, the following measures can be taken for the elimination of such interference:

- * Bridge hinges on front hood and trunk lid with flexible copper grounding ribbon (good ground connection!).
- * Connect antenna base cleanly at the chassis to ground with the help of a copper ground tape.
- * Position radio antenna and transmitter as far as possible in the vehicle from the Jetronic control unit.
- * Adapt transmitter to the radio antenna with the lowest possible reflectance
- * Avoid parallel wire routing of transmitter voltage supply and antenna with the Jetronic wiring harness (danger of coupling and cross feed).



Suppression connector D 280 208 091 (L-Jetronic)
Suppression connector D 280 208 280 (LE-Jetronic)
Illustration similar

If interference is still a problem despite the remedial measures described above, the degree of interference suppression can be improved still further by inserting the suppression connector D 280 208 091 (L-Jetronic), or D 280 208 280 (LE-Jetronic) between the wiring-harness plug and Jetronic control unit.

Ordering:

1. In West Germany
Order the suppression connectors from KH/VDK 2 through Bosch franchised wholesalers.
2. Outside West Germany
RG/AV orders, please use "DB11" order form, from KH/VDK 2.
Price - on request

Responsible:

Division KH

Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

DETERMINATION OF THE TEMPERATURE VALUES GIVEN IN L-JETRONIC MANUALS

VDT-I-280/108 En
05.1982

We have recently been increasingly often asked how accurately the engine temperature must be measured when trouble-shooting on the vehicle.

Up to now, L-Jetronic manuals KH/VSK has given three or four different temperatures for testing the temperature sensor:

- 10° C, + 20° C, + 40° C, and + 80° C

and two ranges for the thermo-time switch, e.g. 35°, C 8 sec.,

below + 30° C and above + 40° C

Since it is unnecessary to apply such close tolerances to the temperature range, in the future we suggest the following more appropriate definitions:

- * Ambient temperature (approx. +15° C to +30° C)
- * Engine at operating temperature (approx. + 80° C).

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ENCODING OF LE/LH-JETRONIC SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En
5.1982

With the introduction of the LE/LH-Jetronic, the internal resistance of the solenoid-operated injection valves has also been changed.

Solenoid-operated injection valve

- * L-Jetronic: 2.5 Ω at + 20° C
- * LE/LH-Jetronic: 16.2 Ω at + 20° C

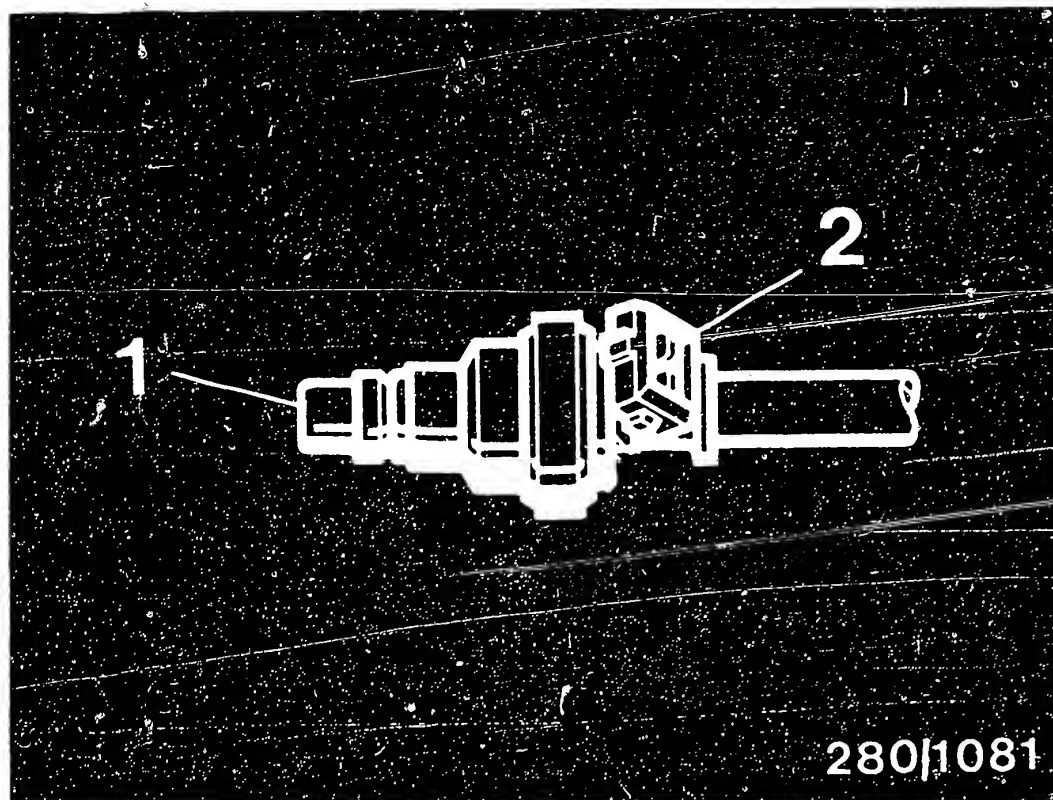
For cost and customer reasons, the plug contact has been left the same.

Caution:

If L-Jetronic solenoid-operated injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the solenoid-operated injection valves will be destroyed.

Note:

- * Install only solenoid-operated injection valves having the correct part number for the vehicle in question.
- * As a guide, solenoid-operated injection valves with 16.2 Ω internal resistance have a yellow protective sleeve.



1 = Protective sleeve 2 = Plug connection

* Color coding (yellow) of the plug connection (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic solenoid-operated injection valves.

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MOTOR VEHICLE SERVICE INFORMATION

EXPORT VEHICLES WITH EMISSION CONTROL SYSTEMS

VDT-I-Gen. 042 En
12.1981

Export vehicles for countries with stringent emission legislation have been equipped with various emission-control systems. To comply with the legal regulations, these systems are installed individually or in combination, depending on the model version.

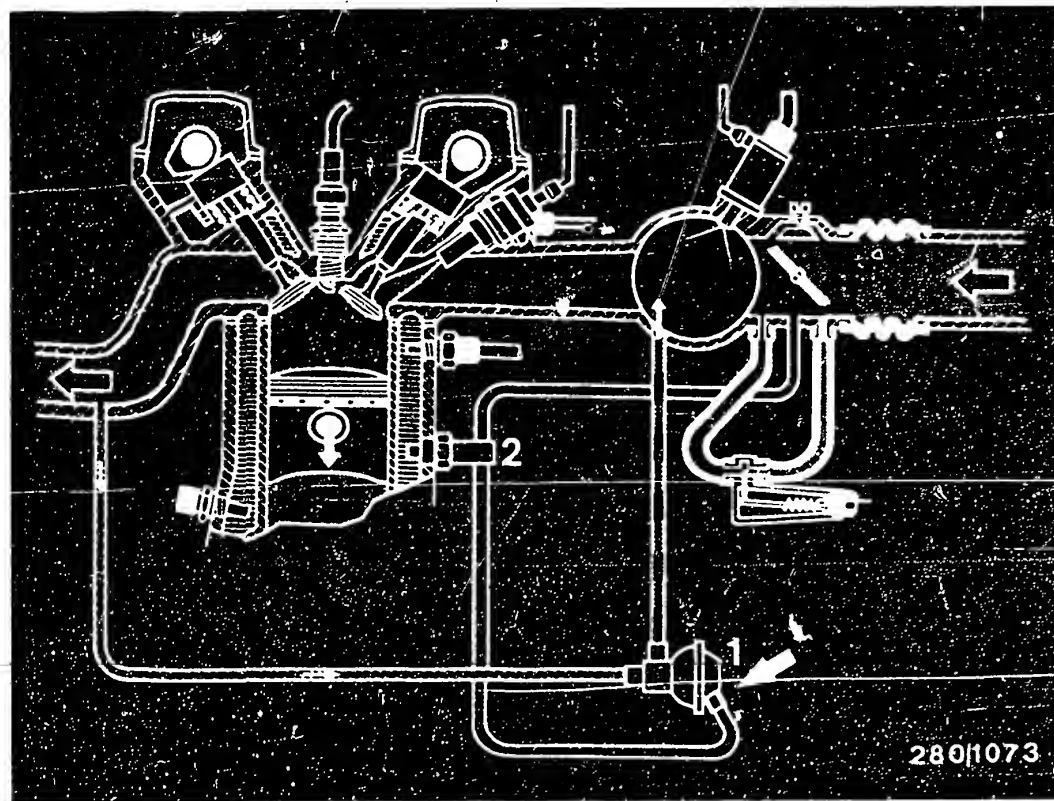
Emission-control system	predominantly used in export vehicles				
	Sweden	Australia	Canada	USA	Japan
EGR 1)	*	*	*	(*)	
Secondary-air induction 1)	*	*	*	(*)	(*)
Secondary-air injection 1)	*	*	*	(*)	(*)
Cat. converter 1)	—	—	—	*	*
Lambda control	—	—	—	*	*

The vehicle-related service manuals for the K- and L-Jetronic describe the construction and operation of the emission-control systems. Their influence must be borne in mind particularly when adjusting the idle and CO.

Export vehicles are found sporadically also in countries in which there is no requirement for particularly stringent emission control. This Service Information provides a general overview of various emission-control systems, as well as information for the after-sales service in countries with emission regulations which do not require such emission-control systems or unleaded fuel.

1) Non-Bosch products

(*) installed in some cases in older vehicles



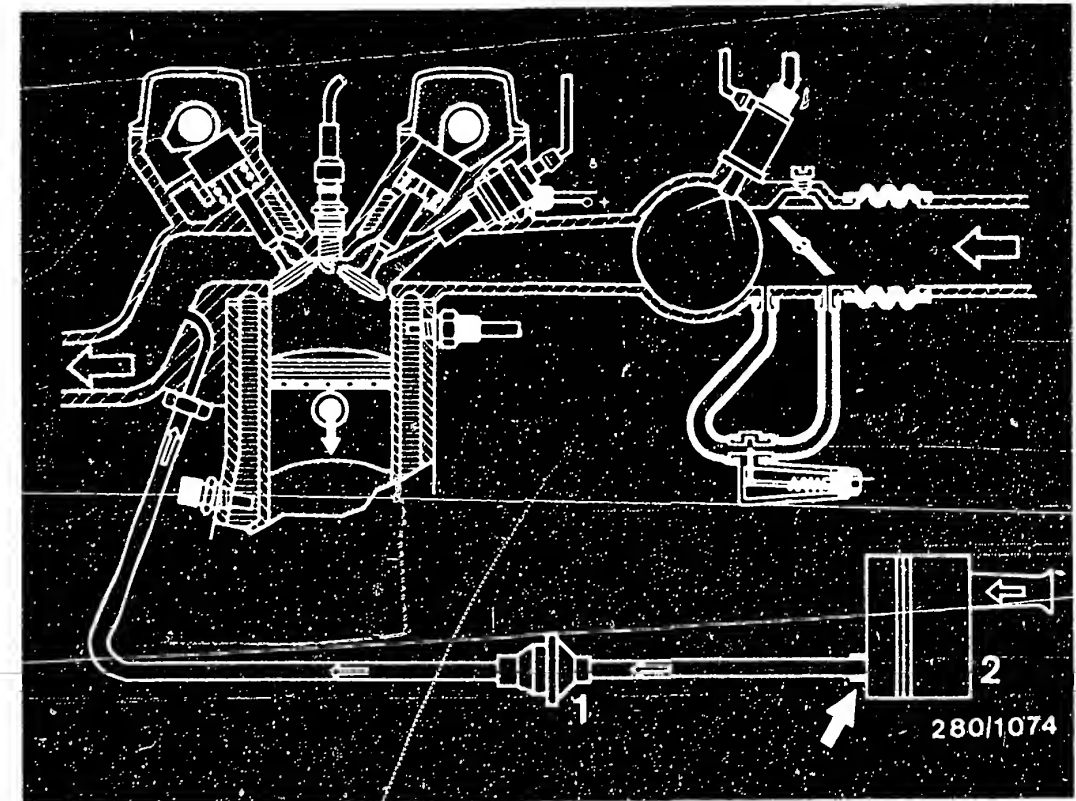
1 = EGR valve 2 = Thermo-valve

1. Exhaust-gas recirculation

(Exhaust Gas Recirculation = EGR)

Some of the exhaust gas is returned to the intake manifold through a vacuum-controlled EGR valve. This reduces the combustion temperature and the emission of nitrogen oxides (NO_x). The thermo-valve and the arrangement of the vacuum tap on the throttle-valve assembly ensure that exhaust gas is recirculated only when the engine is warm, in the part-load range. There is an engine-speed reduction of approx 200 min⁻¹. At idle, full load and with the engine cold, there is no exhaust-gas recirculation.

When checking/adjusting the idle-and CO, disconnect and seal the vacuum control line (arrow) on the EGR valve in order to ensure that the EGR system is rendered inoperative. If the vehicle is operated in countries not having such stringent emission legislation, it is not necessary to shut down the system.



1 = Non-return valve 2 = Air filter

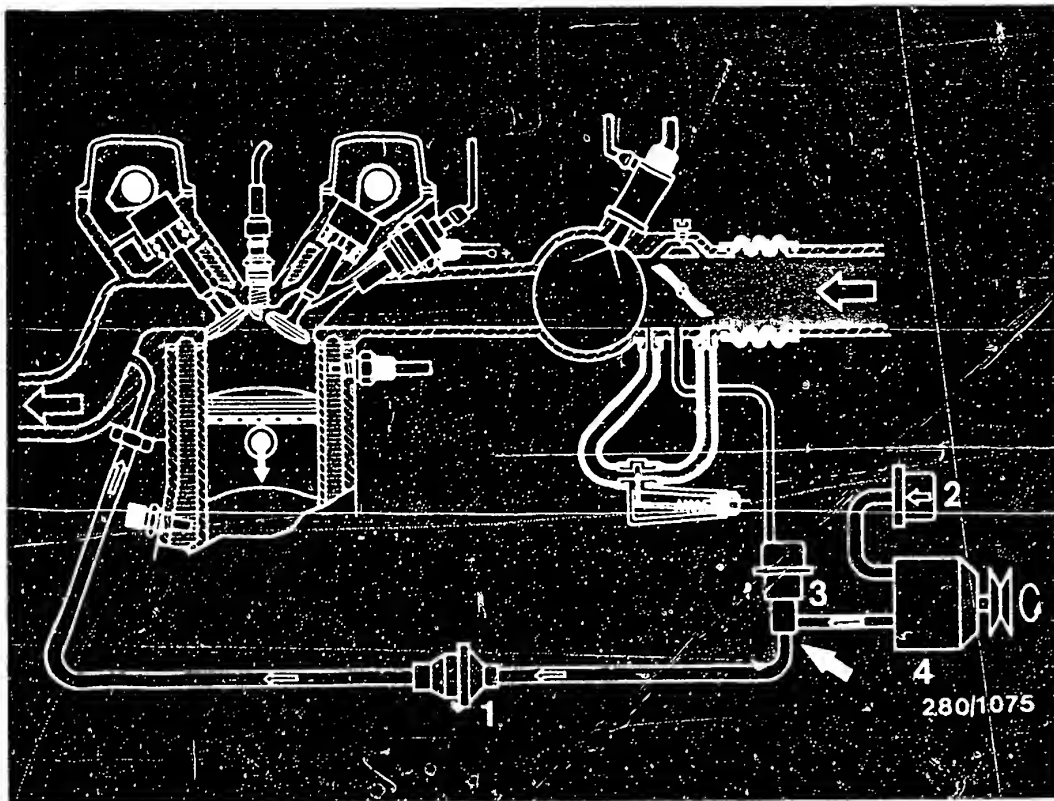
2. Secondary-air induction

(e. g. Volvo Pulsair system)

Due to pressure and vacuum pulsation fresh air is induced by the exhaust gas into the exhaust ports through a non-return valve. Unburned carbon monoxide (CO) and hydrocarbon (HC) residues are partially after-burnt; the exhaust gas then contains fewer pollutants.

When checking/adjusting the idle and CO, the secondary-air induction system must be rendered inoperative. To do this, disconnect hose between non-return valve and air filter on air filter (arrow) and seal tight with a plug.

It is not necessary to shut down the secondary-air induction system if the vehicle is operated in countries not having such stringent emission legislation.



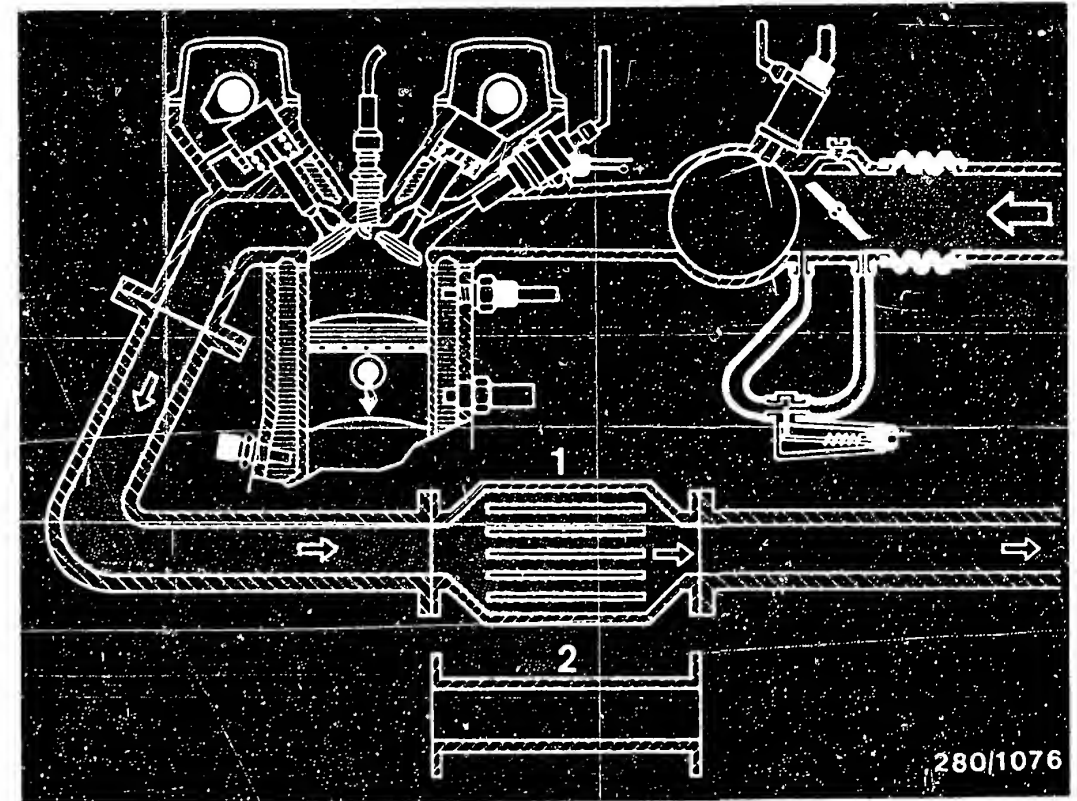
- 1 = Non-return valve 3 = Change-over valve
2 = Air filter 4 = Air pump

3. Secondary-air injection (Air Injection System)

An engine-driven air pump draws in fresh air through the air filter and forces it through a non-return valve into the exhaust ports. As with secondary-air induction, there is a partial afterburning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When checking/adjusting the idle and CO, it is necessary to switch off the air injection system. To do this, disconnect hose at outlet of change-over valve (arrow) and seal tight with a plug.

It is not necessary to shut down the secondary air injection system if the vehicle is operated in countries not having such stringent emission legislation.



- 1 = Catalytic converter 2 = Intermediate pipe

4. Catalytic converter

The single-bed catalytic converter installed in the exhaust system of export vehicles (also with lambda closed-loop control) reduces to a minimum all three pollutants CO, HC and NOx. The catalytic surface triggers off chemical reactions of the pollutants, as a result of which they lose their toxicity.

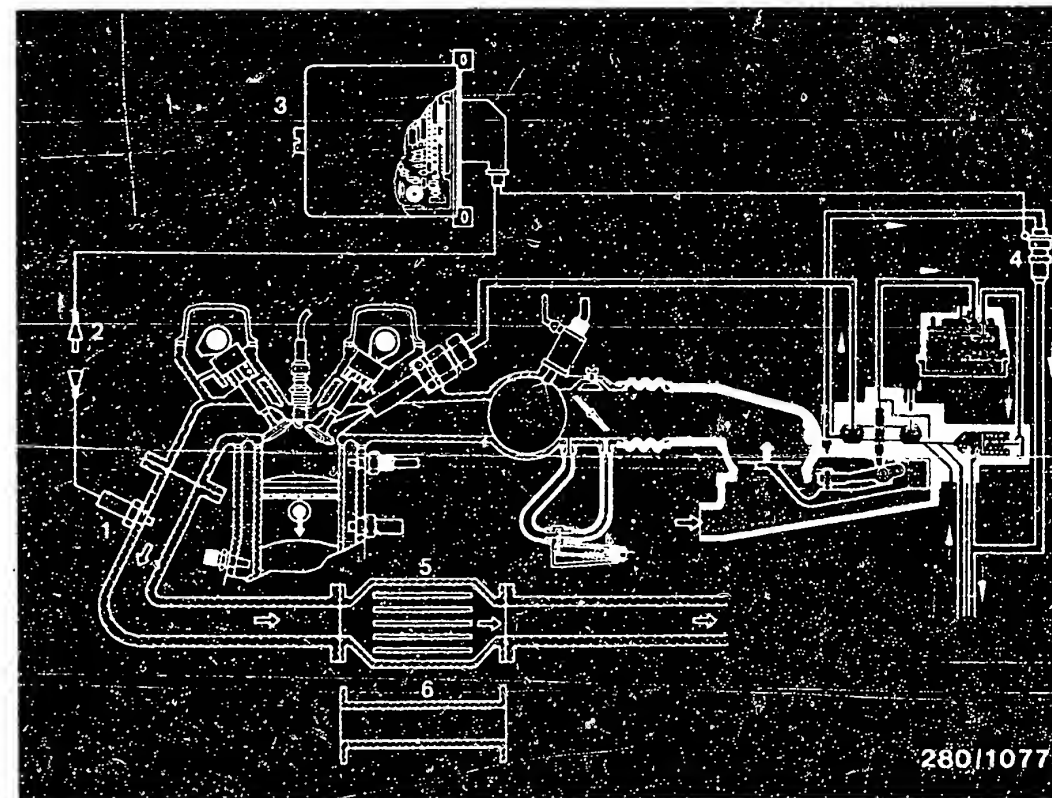
Important: This system can only operate in conjunction with unleaded fuel (currently only in the USA and Japan).

When checking/adjusting the idle and CO, the catalytic converter has no influence since the exhaust sampling point is before the catalytic converter.

Caution:

If the vehicle is operated with leaded fuel (predominantly in countries without stringent emission legislation), the catalytic converter must be removed. Clogging of the catalytic converter would otherwise lead to reduced power from the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.



- | | |
|-------------------|-----------------------|
| 1 = Lambda sensor | 4 = Timing valve |
| 2 = Plug | 5 = Cat. converter |
| 3 = Control unit | 6 = Intermediate pipe |

5. Lambda closed-loop control

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function to the K- and L-Jetronic is not a secondary emission-control system, but ensures low-pollution exhaust gas at the primary stage by means of optimum mixture preparation. In most cases, therefore, it is possible to dispense with additional exhaust-gas recirculation, secondary-air induction or injection. Like the catalytic converter, the lambda sensor (sensor in exhaust gas) also operates only with unleaded fuel.

If the vehicle is operated with leaded fuel, the lambda sensor becomes clogged and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control.

Due to a fixed control function, the system then operates like a K- or L-Jetronic, without lambda closed-loop control.

Before operating with leaded fuel, the lambda sensor should be removed, and the hole should be closed with a screw plug M 18 x 1.5 (thread length max. 8.5 mm).

The disconnected plug (2) of the sensor connecting lead should be insulated and fastened to a suitable point on the vehicle body.

Caution:

Under no circumstances may the control unit or the timing valve be shut down with the lambda closed-loop control of the K-Jetronic.

The catalytic converter should be replaced by an intermediate pipe.

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MOTOR VEHICLE SERVICE INFORMATION

COLD-START, WARM-UP
AND ACCELERATION PROBLEMS

VDT-I-Gen. 051 En
10.1984

(replaces edition of 10.82)

in vehicles with Jetronic

CUSTOMER COMPLAINT

- * Starting problems with cold engine
- * Engine bucking during warm-up
- * Uneven idle (fluctuations in engine speed)
- * Engine missing during acceleration (flat spot)
- * Loss of power

CAUSE

If the ignition and Jetronic have been tested and the correct test specifications have been reached, a possible cause for the problems listed can be coke residue in the intake valves.

The spongy effect of carbon deposits is a hindrance to steady fuel transport from the injection valve to the combustion chamber.

This can cause the air-fuel mixture to become so lean at times that it can no longer be reliably ignited.

Loss of power is the result of a reduction in cylinder charging, and is caused by extreme coking.

Complex interactions of engine-specific characteristics, engine oils used, and fuels, as well as certain driving cycles, can cause such carbon deposits at intake valves.

INSPECTION

If coking is suspected, we recommend that the intake valves be inspected with the help of an endoscope or motoscope.

Deposits on the valve plate or stem can thereby be seen and assessed.

Endoscope manufacturers are, for example:
Karl Storz GmbH & CO Abt. TE, Postfach 4752,
D-7200 Tuttlingen, West Germany, Tel. 07461 - 7080
Richard Wolf GmbH, Postfach 40
D-7134 Knittlingen, West Germany, Tel. 07043 - 351.

REMEDIAL MEASURES

Removal of the affected intake valves and mechanical removal of deposits or use of the "WN 200" walnut-shell-granulate de-gumming system from the Kärcher company.

Information on this system can be obtained from:
Alfred Kärcher GmbH & Co. Reinigungssysteme,
Postfach 160, D-7057 Winnenden, West Germany
Tel. 07195 - 14 - 0 - Telex. 7-24432

ADDITIVES

There are as yet no reliable results on the effectiveness of cleaning and fuel additives. The use of fuel additives can lead to deposits in the fuel system, as well as damaging certain plastic and sealing parts.

Responsible:
Division KH
Technical After-Sales Service (KH/VKD 2)

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MOTOR VEHICLE SERVICE INFORMATION

LPG AND VEHICLES WITH JETRONIC

VDT-I-Allg. 052 En
10.1982

Retrofit conversion

Vehicles with K- or L-Jetronic are not suitable for the subsequent installation of LPG systems.

Such conversion can bring with it numerous problems, such as:

- * Reduction of fuel flow through the injection valves due to deposits.
- * Stiffness or blockage of the K-Jetronic fuel-distributor plunger (through gumming, et. al.) in the course of time with "gas-only operation".
- * Increased danger of intake-manifold back-fire (coughing) and thereby damage to the air-flow sensor.

WARRANTY

Warranty claims on defective Jetronic components from converted vehicles are to be rejected.

Conversion to LP gas operation is at the risk of the vehicle owner.

Responsible:

Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

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